

**RECOVERY PLAN FOR THE  
NORTH ATLANTIC RIGHT WHALE  
(*EUBALAENA GLACIALIS*)**

**REVISION**



Original Approval: December 1991

Prepared by

The Office of Protected Resources  
NOAA Fisheries

Approved : \_\_\_\_\_  
William T. Hogarth, Ph.D.  
Assistant Administrator for Fisheries  
National Oceanic and Atmospheric Administration

Date: \_\_\_\_\_



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## **PREFACE**

Congress passed the Endangered Species Act (ESA) of 1972 (16 USC 1531 *et seq*) to protect species of plants and animals endangered or threatened with extinction. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service share responsibility for the administration of the Act. NMFS is responsible for most marine mammal species including the western North Atlantic right whale. This Plan was written at the request of the Assistant Administrator for Fisheries to promote the conservation and recovery of western North Atlantic right whales.

The goals and objectives of the plan can be achieved only if a long-term commitment is made to support the actions recommended here. Achievement of these goals and objectives will require the continued cooperation of the governments of the United States and Canada. Within the United States, the shared resources and cooperative involvement of Federal, State, and local governments, industry, academia, non-governmental organizations, and key individuals will be required throughout the recovery period.

## DISCLAIMER

Recovery plans delineate reasonable actions which the best available science indicates are required to recover and/or protect listed species. Plans are published by the National Marine Fisheries Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be obtained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Nothing in this plan should be construed as a commitment or requirement that any federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than the National Marine Fisheries Service. They represent the official position of the National Marine Fisheries Service only after they have been signed by the Assistant Administrator. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

## LITERATURE CITATION SHOULD READ AS FOLLOWS:

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National Marine Fisheries Service  
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Silver Spring, Maryland 20910  
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Fees for plans vary depending upon the number of pages. Recovery plans can be downloaded from NMFS website: <http://www.nmfs.noaa.gov/pr/PR3/recovery.html>



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## EXECUTIVE SUMMARY

**Current Species Status:** The North Atlantic right whale (*Eubalaena glacialis*) has been listed as endangered under the Endangered Species Act (ESA) since its passage in 1973 (originally listed as the northern right whale). Historically, right whale populations were severely depleted by commercial whaling. More recently, direct and indirect impacts from human activities -- mostly in the form of vessel collisions and entanglement in fishing gear -- have contributed to a lack of recovery. The population is believed to contain only about 300 individuals and it remains unclear whether its abundance is static, undergoing modest growth or, as recent modeling exercises suggest, currently in decline. Because the right whale is a long-lived species, extinction may not occur in the near future, but the possibility of biological extinction in the next century is very real.

**Habitat Requirements and Limiting Factors:** The North Atlantic right whale primarily occurs in coastal or shelf waters. Individuals in the western North Atlantic population range from winter calving and nursery areas in coastal waters off the southeastern United States to summer feeding grounds in New England waters and north to the Bay of Fundy and Scotian Shelf. For much of the year, their distribution is strongly correlated with the distribution of their prey, which appears to be primarily calanoid copepods in the Northern Hemisphere. It appears that not all reproductively active females return to calving and nursery grounds each year; furthermore, the whereabouts of much of the population during winter remains unknown.

Ship collisions and entanglements in fishing gear are the most common anthropogenic causes of mortality in North Atlantic right whales. Action is urgently needed to reduce these significant threats, and thus improve the survival of right whales. Other potential threats are habitat degradation, noise, contaminants, and climate and ecosystem change. It is necessary to further examine such threats to identify and modify activities that may pose risks to right whales.

**Recovery Strategy:** The most significant need for North Atlantic right whale recovery is to reduce or eliminate deaths and injuries from anthropogenic activities, namely shipping and commercial fishing operations. In addition, the development of demographically-based recovery criteria must be completed quickly. Secondary priorities for the species recovery are characterization, monitoring, and protection of important habitat; and identification and monitoring of the status, trends, distribution and health of the species. Third priorities include conducting studies on the effects of other potential threats and ensuring that they are addressed, and conducting genetic studies to assess population structure and diversity. An overarching need is to work closely with State, other Federal, international and private entities to ensure that research and recovery efforts are coordinated.

**Recovery Goals and Criteria:** The ultimate goal of this recovery plan is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate goal is to reclassify the species from endangered to threatened.

North Atlantic right whales may be considered for *reclassifying to threatened* when all of the following have been met:

- 1) The population structure of right whales (including, but not limited to, such parameters as abundance, growth rate, age structure, gender ratios) is indicative of a biologically significant increasing population;

- 2) The population has increased for a period of 20 years at an average rate of increase of 2% per year or more;
- 3) All five listings factors are addressed; and
- 4) Given current and projected conditions, the population has no more than a 1% chance of quasi-extinction in 100 years.

Criteria for *delisting* North Atlantic right whales are not included this recovery plan because the current abundance of North Atlantic right whales is an order of magnitude less than an abundance at which NMFS would even consider delisting the species, and decades of population growth likely would be required before the population could attain such an abundance. In addition, conditions related to delisting are now too distant and hypothetical to realistically develop specific criteria. Such criteria will be included in a future revision of the recovery plan well before the population is at a level when delisting becomes a reasonable decision.

**Estimated Cost of Five-Year Recovery Efforts (in thousands):**

Year	Action 1	Action 2	Action 3	Action 4	Action 5	Yearly Total
FY01	6,050	---	735	2,365	180	9,330
FY02	6,250	---	865	2,645	200	9,960
FY03	5,505	---	880	2,630	250	9,265
FY04	4,675	---	770	2,360	250	8,055
FY05	4,565	---	595	2,235	300	7,695
<b>Totals</b>	<b>27,045</b>	<b>---</b>	<b>3,845</b>	<b>12,235</b>	<b>1,180</b>	<b>44,305</b>

**Total Estimated Cost of Recovery:** The total estimated cost of recovery cannot be determined, as it will likely take numerous decades, and many management activities that are currently impossible to predict, to bring the species to a point at which the protections of the ESA are no longer warranted. Total Estimated Cost of Recovery: The total estimated cost of recovery cannot be determined, as it will likely take numerous decades, and many management activities that are currently impossible to predict, to bring the species to a point at which the protections of the ESA are no longer warranted.

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## I. BACKGROUND

### A. Brief Overview

The North Atlantic right whale, *Eubalaena glacialis*, is among the rarest of all large whale species, and among the rarest of all marine mammal species. It has been listed as endangered under the Endangered Species Act (ESA) since its passage in 1973 (35 FR 8495, June 2, 1970). Although precise estimates of abundance are not available, it appears that the eastern North Atlantic population is nearly extinct and the western North Atlantic population numbers approximately 300 whales.

At its 1983 right whale workshop, the IWC considered hypotheses regarding the distinctiveness of three right whale stocks in the North Atlantic: an eastern, central, and western population or stock. Whaling records indicate that the central stock may have existed in the central Atlantic Ocean, and migrated from east of Greenland to the Azores or Bermuda (Reeves and Mitchell 1986). However, given the uncertainty of a central population, the workshop agreed to a provisional division of eastern and western stocks (IWC 1986).

The eastern North Atlantic population probably numbers only in the low tens of animals at best, and may be functionally extinct (Best *et al.* 2001). The western North Atlantic population is the largest right whale population in the Northern Hemisphere. Nonetheless, as of the writing of this plan, the population is believed to contain only about 300 individuals and it's unclear as to whether its abundance is remaining static, undergoing modest growth or, as recent modeling exercises suggest, in decline (Caswell *et al.* 1999).

Rosenbaum *et al.* (2000) used mitochondrial DNA (mtDNA) extracted from museum specimens of baleen to examine historic genetic structure in right whales. This work includes the only available analysis of eastern North Atlantic specimens, and suggests that the eastern and western populations were not historically distinct. The analysis also suggests that little genetic variation has been lost in the 20<sup>th</sup> century, although it is recognized that the greatest loss of variation is likely to have occurred well prior to this, during periods of major exploitation.

From mtDNA analysis, Schaeff *et al.* (1993) suggested that western North Atlantic right whales are a single breeding population that consists of three matriline. Further work has identified two additional matriline (Malik *et al.* 1999), and the five mtDNA haplotypes vary greatly in their present frequency within the population. Skin biopsy sampling has resulted in compilation of a DNA library of almost 300 North Atlantic right whales, i.e., the majority of the population. When analysis of these samples is complete, an assessment of the genetic variation of the population will be available and identification of stock structure may be further elucidated.

Historically, right whale populations were severely depleted by commercial whaling. More recently, direct and indirect impacts from human activities -- mostly in the form of vessel collisions and entanglement in fishing gear -- almost certainly have contributed to a lack of recovery in the North Atlantic. Action is urgently needed to reduce the frequency of collisions with ships and fishing gear entanglements, and thus to improve the survival of right whales.

There is reason for serious concern about the future of North Atlantic right whales. Because the right whale is a long-lived species, extinction may not occur in the near



future, but the possibility of biological extinction in the next century is very real. A number of proactive steps are needed by a variety of public and private entities.

Much attention has focused on right whales in recent years. Efforts to protect the North Atlantic right whale population increased significantly in 1992-1993 following completion of the first Recovery Plan (NMFS 1991) and substantial annual increases in Federal funding allocated toward recovery of endangered species, including the right whale, listed under the ESA. Scrutiny of, and the number of restrictions on, commercial fishing activities has also increased in the last decade as efforts have been made to reduce levels of fishing gear entanglement. In addition, NMFS has conducted a number of consultations with other Federal agencies under the ESA, and involvement in right whale recovery by those and other agencies has increased significantly. Regional Recovery Plan Implementation Teams have been established to review recovery activities and recommend improvements, and Take Reduction Teams have been established under the 1994 amendments to the Marine Mammal Protection Act (MMPA) to develop and implement plans to reduce mortality and serious injury. In spite of these efforts, recovery appears to be slow or absent.

## B. Description and Taxonomy

The North Atlantic right whale, *Eubalaena glacialis* (Müller 1776), is a large baleen whale. Adults are generally between 45 and 55 feet in length and can weigh up to 70 tons. Females are larger than males. Distinguishing features for right whales include a stocky body, generally black coloration (although some individuals have white patches on their undersides), lack of a dorsal fin, a large head (about 1/4 of the body length), strongly bowed margin of the lower lip, and callosities on the head region. Two rows of long (up to about eight feet in length), dark baleen plates hang from the upper jaw, with about 225 plates on each side. The tail is broad, deeply notched, and all black with smooth trailing edge.

The southern right whale, *Eubalaena australis* (Desmoulins 1822), and the North Pacific right whale, *E. japonica* (Lacépède 1818), are separate but closely related species. For many years, the distinction between *E. glacialis* (the “northern” right whales, understood to include animals in both the North Atlantic and North Pacific Oceans) and *E. australis* (the southern right whale) was based upon a single morphological character in the orbital region of the skull (Muller 1954). Recent genetic studies have made it possible to re-evaluate the taxonomy of right whales, and Rosenbaum *et al.* (2000) reported strong evidence of separate specific status for North Atlantic and North Pacific right whales. NMFS formally recognized the North Atlantic and North Pacific as separate species and updated the List of Threatened and Endangered Wildlife to reflect this on April 10, 2003 (68 FR 17560). Thus, both the International Whaling Commission (IWC) (IWC 2001) and NMFS recognized three right whale species: *E. glacialis*, *E. japonica*, and *E. australis*. A separate plan is being prepared for *E. japonica*.

### C. Distribution and Habitat Use

Right whales have occurred historically in all the world's oceans from temperate to subpolar latitudes. The pre-exploitation distribution of the North Atlantic right whale probably included coastal and continental shelf waters in temperate to subarctic latitudes of the North Atlantic Ocean. Post-exploitation distribution is much more limited.

Right whales are frequently found in coastal or shelf waters, although movements over abyssal depths are known (Scarff 1986; Mate *et al.* 1997). For much of the year, their distribution is strongly correlated to the distribution of their prey, which appears to be primarily calanoid copepods in the Northern Hemisphere. During the winter in both hemispheres, many right whales have been observed in the coastal waters of lower latitudes where calving takes place. These animals migrate to higher latitudes during spring and summer. In both the North Atlantic and the Southern Hemisphere, it appears that not all reproductively active females return to calving grounds each year (Kraus *et al.* 1986; Payne 1986); furthermore, the whereabouts of much of the population during winter remains unknown.

#### *Western North Atlantic population*

Individuals in the western North Atlantic population range from wintering and calving areas in coastal waters off the southeastern United States to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf. However, occurrence of some individuals has been reported as far north as Newfoundland, the Labrador Basin, the southeast of Greenland (Knowlton *et al.* 1992), and Norway, and sightings have been reported as far south as the Gulf of Mexico (Moore and Clarke 1963; Schmidly *et al.* 1972). Five areas of "high use" were identified in the previous Recovery Plan for the Northern Right Whale (NMFS 1991), and they are still key habitat areas for right whales:

- 1) Coastal Florida and Georgia (Sebastian Inlet, Florida to the Altamaha River, Georgia)
- 2) The Great South Channel (east of Cape Cod)
- 3) Massachusetts Bay and Cape Cod Bay
- 4) The Bay of Fundy, and
- 5) The Scotian Shelf, including Browns and Baccaro Banks, Roseway Basin and areas to the east

The first three of these areas were designated as northern right whale critical habitat in June 1994. Right whales occur off New England at various times, with a peak occurrence in winter/spring (Hamilton and Mayo 1990). Peak abundance occurs in the Great South Channel in spring (Kenney *et al.* 1995; Kenney 2001). In summer and fall, much of the population is found in Canadian waters (i.e., the Bay of Fundy and Scotian Shelf, with the former area being a major summer nursery ground) (Mitchell *et al.* 1986; Winn *et al.* 1986; Stone *et al.* 1990). Whales seen in the Roseway Basin/Browns Bank region were primarily juvenile and adult males (Brown *et al.* 2001), whereas most of the summer/autumn sightings of mother/calf pairs have been in the Bay of Fundy (Kenney *et al.* 2001). However, the former area appears to have been largely abandoned in 1993, and the population composition in the Bay of Fundy has recently been much more mixed than it was previously.

Known wintering areas for this population are along the southeastern U.S. coast, where calving occurs from December through March (Winn 1984; Kraus *et al.* 1986; International Whaling Commission 1986), and in Cape Cod Bay where, in 1998, whales

were sighted from mid January to mid May (Brown and Marx 1998). However, a majority of the population is unaccounted for in winter (Kraus *et al.* 1986). Other wintering areas have been suggested, based upon sparse data; these include the Gulf of St. Lawrence (Lien *et al.* 1989), Newfoundland (Beamish 1981; Lien *et al.* 1989), New York and New Jersey coastal waters (Mead 1986), Bermuda (Payne and McVay 1971), and the Gulf of Mexico (Mead 1986) (see Reeves 2001 for a review). Telemetry studies have revealed movement patterns of considerable length and duration (Mate *et al.* 1997; Slay *et al.* 1998).

Right whales have been sighted in waters off Massachusetts in most months (Watkins and Schevill 1982; Schevill *et al.* 1986; Winn *et al.* 1986; Hamilton and Mayo 1990). Most sightings occur between February and May, with peak abundance in late March. Schevill *et al.* (1986) reported 764 sightings of right whales between 1955 and 1981 in Cape Cod waters. More than 70 right whales were seen in one day in 1970. Hamilton and Mayo (1990) reported 2,643 sightings of 113 individual right whales in Massachusetts waters, with a concentration in the eastern part of Cape Cod Bay. A number of right whales, including cow/calf pairs, resided in Cape Cod and Massachusetts Bays during the summers of 1986 and 1987, which may have been related to shifts in abundance of prey in adjacent waters (Hamilton and Mayo 1990; Payne *et al.* 1990).

Information on residency times of individual whales at specific sites is ambiguous, especially in light of recent satellite transmitter results indicating right whales tagged in the Bay of Fundy may travel long distances in the few days or weeks between sightings (Mate *et al.* 1997). Schevill *et al.* (1986) reported individual right whales residing in Cape Cod waters for no more than a few days. In 1976 they observed a cow and calf over a 7-week period, the longest residence time documented during observations between 1955 and 1981. Prior to 1986, Hamilton and Mayo (1990) reported observations of individual whales up to 12 times in a year, with the longest apparent residency being 89 days. Fifty percent of individual right whales sighted by Hamilton and Mayo (1990) were seen in more than one year.

Waters south of Cape Cod and north of the Georgia/Florida winter calving ground, especially waters off New York/New Jersey and the “mid-Atlantic” states, have not been considered to include “high use” areas, yet the whales clearly move through these waters regularly (Reeves *et al.* 1978; Reeves and Mitchell 1986; Winn *et al.* 1986; Reeves *et al.* 1999). They may also feed, at least opportunistically, while migrating. It may be reasonable to give priority to the protection of the whales and their habitat in known high-use areas, although attention is also needed in the connecting waters between such areas, including waters far offshore (e.g., Mate *et al.* 1997). Successful efforts to protect the whales in areas where they linger for long periods and/or aggregate in relatively high densities could be offset if the animals were to be exposed to serious risks of collision or entanglement while in transit between such areas.

### *Eastern North Atlantic Population*

The eastern North Atlantic right whale population may originally have migrated along the coast from northern Europe to the northwest coast of Africa. The population was heavily exploited by whalers in the Bay of Biscay (off southern Europe) and Cintra Bay (off the northwestern coast of Africa), as well as off coastal Iceland and the British Isles during the 14<sup>th</sup> through 16<sup>th</sup> centuries. It is clear from historical records that Cintra Bay was also heavily exploited by whalers from 1855-1880 (Reeves 2001), where right whale mothers and calves visited coastal waters during winter months. More recently, an intense period of whaling in the eastern North Atlantic between 1902 and 1967 (including harvest off

the Shetlands, Hebrides and Ireland in the years 1906-1910) was particularly catastrophic for the eastern North Atlantic right whale population. Since that time, there have only been sporadic sightings of right whales in the eastern North Atlantic (Best *et al.* 2001). In two recent winter surveys of Cintra Bay, no evidence was found to suggest that right whales still use the area; this absence of evidence also corresponds to a lack of recent observations in northern European waters (Reeves 2001).

Based on the paucity of sighting information, current distribution and migration patterns of the eastern North Atlantic right whale population, if it remains extant, are unknown. The 1998 IWC Workshop on the Comprehensive Assessment of Right Whales agreed that only animals found in the western North Atlantic can be considered a functioning extant unit based on current sightings information. Animals found in the eastern North Atlantic may be considered as a 'relict' population or populations (Best *et al.* 2001).

#### **D. Critical Habitat**

As noted above, there are five well-known habitats used annually by western North Atlantic right whales: 1) coastal Florida and Georgia, 2) the Great South Channel, east of Cape Cod, 3) Cape Cod and Massachusetts Bays, 4) the Bay of Fundy, and 5) Browns and Baccaro Banks, south of Nova Scotia. The first three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (59 FR 28793). See Appendix D.

On July 11, 2002, NMFS received a petition to revise and expand the designation of critical habitat for this species. On November 19, NMFS found this petition to present substantial scientific information indicating that the revision may be warranted and solicited public comment on the petition (67 FR 69708). On August 28, 2003, NMFS determined that the requested revision, as specified by the petitioner, was not warranted at this time. However, NMFS plans to continue to analyze the physical and biological habitat features essential to the conservation of North Atlantic right whales, and outlined the steps it will take to further investigate those features and to propose any revisions to designated critical habitat that might be supported by new information and analysis (68 FR 51758). In the meantime, the critical habitat designated in 1994 remains in place.

Actions authorized, funded, or carried out by Federal agencies that may have an impact on critical habitat must be consulted upon in accordance with Section 7 of the Endangered Species Act (ESA), regardless of the presence of right whales at the time of impacts. Impacts on these areas that may affect primary constituent elements such as prey availability and the quality of nursery areas must be considered when analyzing whether habitat may be adversely modified.

## **E. Life History**

### **E.1 Reproduction**

Most known right whale nursery areas are in shallow, coastal waters. In the western North Atlantic, calving takes place between December and March. In both the northern and southern hemisphere, females give birth to their first calf at an average age of nine years (Best *et al.* 1998; Hamilton *et al.* 1998a). Calves are 5.5-6.0 meters in length at birth (Best 1994). Gestation lasts from 357 to 396 days in southern right whales (Best 1994), and it is likely to be similar in the northern species. Weaning seems to be variable, and has been reported as 8 to 17 months in North Atlantic right whales (Hamilton and Marx 1995).

Standard reproductive rates for the western North Atlantic population have yet to be calculated, and this is complicated by the occurrence patterns of mature females, for whom the probability of sighting in studied habitats is dependent upon reproductive condition. The number of calves observed in this population since 1993 has varied from one (in 2000) to 31 (in 2001) (Knowlton *et al.* 1994; A. Knowlton, pers. comm.), but how these figures translate into standard birth rates is unclear. In 2000, one new calf was observed; 31 calves, 27 believed to survive, were reported in 2001. Calf production for the last two decades has averaged around 11 individuals per year. The calving interval for right whales is between 2 and 7 years, with means ranging from 3.12 (95% CI 3.05-3.17) to 3.67 years (95% CI 3.3-4.1) (Knowlton *et al.* 1994; Best *et al.* 2001; Burnell 2001; Cooke *et al.* 2001). However, in the western North Atlantic, there has been a recent significant increase in the calving interval from 3.67 years for the period 1980 to 1992 (Knowlton *et al.* 1994) to 5.8 years for the period 1990 to 1998 (Kraus *et al.*, 2001). This longer calving interval is markedly different from that of southern right whale populations, whose mean calving interval is between three and four years, with modes generally around three years. The increase in the interval is of particular concern and, together with other perplexing biological parameters, may suggest the population is under rather unusual biological, energetic, or reproductive stress.

It is possible to calculate a theoretical maximum birth rate from knowledge of three parameters: sex ratio, proportion of females that are sexually mature, and mean interbirth interval. The sex ratio of the western North Atlantic population is known to be even (Brown *et al.* 1994), and recent work by Hamilton *et al.* (1998a) has suggested that 60% of females in this population are mature. Given a normal average interbirth interval of 3 years, the expected maximum annual birth rate should be approximately 0.10 ( $1.00/2/1.67/3$ ). A longer interbirth interval (such as that suggested above), or a lower proportion of mature (or reproductively active) females, would decrease this rate accordingly.

### **E.2 Natural Mortality**

Deaths resulting from human activities account for one-third of all known mortalities in the western North Atlantic right whale population (Kraus 1990). The extent to which natural factors, such as disease and predation, affect mortality rates is not known. Kraus (1990) used photo-identification data from the western North Atlantic population to calculate an average mortality rate of 17 percent per year in first-year right whales, while second- through fourth-year whales had an average mortality rate of 3 percent per year. Including all sources of mortality, both natural and anthropogenic, 27 percent of all western North Atlantic right whales die before reaching four years of age (Kraus 1990).

An unusually high number of right whale deaths occurred off the southeast United States from January through March 1996, when five deaths were reported. Of these, four were recovered and examined for cause of death. Of those recovered, one was killed by a ship strike, but the cause of death could not be determined for the remainder.

Various species of large sharks and killer whales (*Orcinus orca*) may be predators of right whales, particularly for young or sick individuals. However, no such attacks have been observed in this species. Scars from killer whale attacks have been photographed on North Atlantic right whales (Kraus 1990), although the level of killer whale attacks and the extent to which they result in death is not known.

### **E.3 Feeding and Prey Selection**

In the western North Atlantic, right whales feed primarily on copepods, with *Calanus finmarchicus* believed to be the primary prey (Kraus *et al.* 1988; Wishner *et al.* 1988; Murison and Gaskin 1989). However, other zooplankters are also taken, including *Pseudocalanus*, *Centropages*, and even cyprids (Mayo and Marx 1990). There is no evidence for consumption of euphausiids although, given the inclusion of this taxon in the diet of right whales elsewhere, it would be surprising if North Atlantic right whales were different in this regard. Unlike balaenopterid whales, right whales are skimmers; they feed by continuously filtering prey through their baleen while moving, mouth agape, through a patch of zooplankton.

Feeding occurs from spring through fall, and also in winter in certain areas (e.g., Cape Cod Bay; Mayo and Marx 1990). Oceanographic and bathymetric features, such as relatively cooler water temperatures and 100-200 m depths adjacent to steeply sloping bottom topography, also seem to be related to the utilization of certain areas for feeding (Winn *et al.* 1986; Clapham 1999).

### **E.4 Competition**

It has been suggested that interspecific competition with either sei whales (*Balaenoptera borealis*) or planktivorous fish may limit northern right whale prey consumption (Mitchell 1975; Kraus *et al.* 1988; Payne *et al.* 1990). In the North Atlantic, sei whales are sympatric with the right whales, and because both species feed on small zooplankton species, they may compete (Mitchell 1975). There is also speculation about competition with certain species of fish in the Gulf of Maine, including sand lance (*Ammodytes* spp.), herring (*Clupea* spp.), Atlantic mackerel (*Scomber scombrus*), river herrings (shad, blueback; *Alosa* spp.), menhaden (*Brevoortia tyrannus*), and basking sharks (*Cetorhinus maximus*). However, as noted by Clapham and Brownell (1996), assertions regarding interspecific competition are rarely well defined or ecologically based; while the potential for interference competition exists for right whales, direct evidence is essentially absent.



## F. Abundance and Trends

The eastern North Atlantic population probably numbers only in the low tens of animals at best, and is not considered a functioning extant unit based on current sightings information (Best *et al.* 2001); see discussion under C. Distribution and Habitat Use).

Based on a census of individual whales identified using photo-identification techniques, the western North Atlantic population size was estimated to be 295 individuals in 1992 (Knowlton *et al.* 1994). Kraus *et al.* (2001) provided population size estimates based on a multi-year running total of catalogued animals, and based on these numbers the 1998 IWC right whale workshop accepted an estimate of about 300 individuals for this population (IWC 1998). However, because of heterogeneity of capture probabilities (relating to either distribution of individuals and/or of sighting effort), calculation of an unbiased point estimate of abundance for this population is difficult, and population modeling approaches to estimating abundance are considered preferable by NMFS.

The estimated rate of increase for the western North Atlantic population from 1986-1992 was calculated at 2.5 percent (CV=0.12) using photographic identification techniques (Knowlton *et al.* 1994). Estimates by Kraus *et al.* (2001) were used to obtain an annual rate of increase (range -0.039 to +0.031) for each of the years 1987 to 1996. A regression estimate based on these data is probably negatively biased ( $r=0.01$ ,  $SD=0.0232$ ) because of reduced sampling effort in recent years. During the 1998 IWC right whale workshop, two alternative methods were used to obtain estimates of the rate of increase for this population. One provided an estimate of 1.59 percent (C.I. -0.0246, 0.0564) with the caveat that the result is for recent years. The second suggests that 4.3 percent is an upper bound to the population growth rate. With regard to the latter estimate, the IWC report stated that “[a]lthough actual growth rates are likely to be considerably less than this, this figure serves to illustrate that the growth rate of the North Atlantic right whale is both low and substantially less than that of southern right whale populations.” In contrast, Southern Hemisphere right whale populations (those off Argentina, Australia and South Africa) are increasing at annual rates on the order of 7-8 percent (IWC 1998).

With regard to the western North Atlantic population, the IWC workshop report also stated the following:

Whereas it may have increased since protection in 1935... and may still be increasing at a modest rate (about 2.5 percent) in the 1980s (Knowlton *et al.* 1994), more recent data (near-failure of calf production from 1993-95, increased calving interval, and a relatively large number of human-induced mortalities) suggest that this modest recovery rate (by comparison to the Southern Hemisphere) may not have continued in the 1990s. North Atlantic parous females show an increase between 1985 and 1997 but with an apparent long-term oscillation in recruitment. These features together with the lack of significant increase in calving rates, support the need for age-structured models to account for the complexity of this population's dynamics. It is now unclear whether the population is declining, stationary or increasing and the best estimate of current population size is only 300 animals.

A recent modeling exercise, which calculated crude survival probability from photographically identified individuals (Caswell *et al.* 1999), found that these rates decreased from about 0.99 per year in 1980 to about 0.94 in 1994, and that population growth rate declined from about 5.3 percent in 1980 to a negative 2.4 percent in 1994. The model suggested further that, under current conditions, the population is headed for extinction and an upper bound on the expected time to extinction was 191 years.

## **G. Threats**

Ship collisions and fishing gear entanglements are the most common anthropogenic causes of mortality in western North Atlantic right whales, judging from observations of stranded animals. Other potential threats are habitat degradation, noise, contaminants, underwater bombing activities, climate and ecosystem change, and commercial exploitation.

### **G.1 Vessel Interactions**

The greatest known current cause of right whale mortality in the western North Atlantic is collision with ships. Out of 27 documented deaths from 1970 through 1991, 22 percent were caused by ship propellers severing the tail stock or spine, or causing mortal wounds on the head region (NMFS 1991). From 1991 through the beginning of 1993, an additional 3 deaths were reported as a result of collisions with vessels (Kenney and Kraus 1993). Of 45 confirmed deaths of western North Atlantic right whales between 1970 and 1999, 16 are known to have been caused by ship strikes and two additional collisions were judged as possibly fatal (Knowlton and Kraus (2001)). There was one known ship struck right whale death in 2001 and two in 2002. The low incidence (7 percent) of photographically identified whales showing scars and wounds from ship propellers compared to the high rate of ship propeller wounds on stranded carcasses indicates that a high proportion of interactions between ships and whales are fatal to the whale (Kraus 1990). It should be noted that with improved reporting and more thorough necropsies in recent years, the rate of detection and confirmation of ship-strike deaths has probably increased. This may confound efforts to determine trends in the frequency of collisions. Laist *et al.* (2001) argued that ship speed was an important factor in the frequency of occurrence of ship strikes in large whale species, including right whales.

Concern has been raised over the possible adverse effects of whale-watching activities on right whale aggregations, particularly in the western North Atlantic (i.e., Cape Cod Bay and lower Bay of Fundy). While adverse effects from this activity are possible, there are no data that conclusively establish adverse effects beyond the possibility of ship strikes, and recent minimum distance regulations (i.e., 500-yard no approach regulations for right whales) are designed to reduce the threat of collision or harassment in U.S. Atlantic waters. That is, most effects from whale-watching activities are likely limited to behavioral changes or perhaps relatively small changes in distribution. Given the above-mentioned regulations on vessel approaches to right whales, the potential for temporary, perhaps relatively minor, effects has been reduced. However, relatively recent collisions between whale-watching boats and a humpback (2001), and a minke whale (1998) indicate that much more serious consequences, e.g., death or serious injury, are also possible. In addition, the number of high-speed (capable of speeds >28 knots) whale-watch vessels, ferries, and other craft has increased recently in areas where right whales occur, and this means that the threat of collisions has grown. Therefore, it may be necessary to examine the effects of whale watching on right whales and issue regulations and/or guidelines regarding the number of vessels, and their speed, manner and distances of approaches near whales.

### **G.2 Entrapment and Entanglement in Fishing Gear**

Kraus (1990) estimated that 57 percent of right whales in the western North Atlantic bear scars and injuries indicating fishing gear entanglement. This figure was revised to 61.6 percent by more recent analysis (Hamilton *et al.* 1998b). The 1998 North Atlantic Stock

Assessment Report (Waring *et al.* 1999) indicated NMFS-monitored fisheries showed a mean annual mortality of 1.0 right whale from 1992 through 1996. Sources of interaction mainly lie with gill-nets, lobster pots, seine nets, and fish weirs (NMFS 1991), which, with the exception of gillnet fisheries, are largely not monitored. Gear entanglement was estimated to account for 7 percent of the known mortality in right whales in the western North Atlantic from 1970 through early 1993 (Kenney and Kraus 1993), and there were at least two additional entanglement deaths between late 1993 and 1999 (Knowlton and Kraus 2001). These mortalities involved entanglements with fixed fishing gear. Of 45 known deaths between 1970 and 1999, three were directly linked to entanglements and eight were suspected to have been linked to entanglements. Entanglements may be responsible for more deaths than indicated by the stranding and necropsy data. Not only is fishing gear likely to have been implicated in some of the deaths for which a cause could not be determined, but also some whales may have become entangled, drowned, and failed to resurface. As a result of the 1997 NMFS review of stranding and entanglement records of large whales from 1990-1994, NMFS changed the classification of the Gulf of Maine and U.S. Mid-Atlantic lobster pot fisheries from Category III to Category I, based on the annual level of incidental mortality and serious injury of marine mammals relative to each stock's calculated Potential Biological Removal (PBR) level<sup>1</sup>. Two of the examined mortality records involved right whales. This classification has not changed to date.

Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to some other direct cause of mortality (Kenney and Kraus 1993). Entanglement-related stress may decrease an individual's reproductive success or reduce its life span, which may in turn depress population growth.

### **G.3 Habitat Degradation**

A continued threat to the coastal habitat of the right whale in the western North Atlantic is the undersea exploration and development of mineral deposits, as well as the dredging of major shipping channels. Offshore oil and gas activities have been proposed off the coast of the mid- and south- Atlantic U.S. (NMFS 1991), but NMFS is not aware of any current plans to explore or develop oil resources in this region. Right whales also frequent coastal waters where dredging and its associated disposal operations occur on a regular basis, such as along the southeastern U.S. coast. The U.S. Army Corps of Engineers (ACOE) has responsibility/oversight for many of these dredging and disposal operations and has consulted with NMFS under Section 7 of the ESA on these activities. As a result, engaging in dredging operations and related activities requires protective measures such as posting lookouts on dredge vessels and adherence to recommended precautionary guidelines for operations to reduce the risk of collision.

It is unknown to what extent these activities may disturb or otherwise affect right whales. It appears that whale behavior and the type of activity in which they are engaged influence right whale sensitivity to, and tendency to avoid, noise disturbance and vessel activity (Watkins 1986; NMFS 1991), but more studies are needed.

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<sup>1</sup> Potential Biological Removal (PBR) level is defined under the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing the stock to reach or maintain its optimum sustainable population. The potential biological removal level is the product of a) the minimum population level of the stock; b) one-half the theoretical or estimated net productivity rate of the stock at a small population size; and c) a recovery factor between 0.1 and 1.0.

## **G.4 Noise**

A review of impacts of noise of all types on marine mammals is provided by Richardson *et al.* (1995). Although certain species of large whale have shown behavioral changes to anthropogenic noise sources in the marine environment, there have been few studies of the effects of anthropogenic noise on right whales specifically. In general, the impact of noise from shipping or industrial activities on the communication, behavior and distribution of right whales remains unknown.

The recent development of an archival tag, called a DTAG, may yield insight into large whale responses to noise by monitoring behavior and response to sound continuously throughout the dive cycle. A built-in hydrophone on the DTAG records acoustics while a series of sensors sample the orientation of the animal, its speed, and fluke strokes. The timing of sound and motion are synchronized due to the precise audio and sensor recording. The DTAG has been attached to right whales and sperm whales, and may contribute valuable information to measure the response of marine mammals to sound (Johnson and Tyack 2003). In 2001, DTAG's were attached to 31 right whales to investigate the whales' reactions to the presence of ships. Researchers conducted ten controlled sound exposures to tagged whales, and charted the movements of 34 vessels. By comparing experimental and control situations, response is evaluated through a detection of changes in fluke stroke rate, orientation, heading, depth, and vocal activity. As these data are analyzed, right whale response in the presence of ships may be better understood (Nowacek *et al.* 2001).

## **G.5 Contaminants**

Contaminant data on right whales are restricted to data from biopsy-derived samples. These data appear to be relevant to the whole animal given that lipid-normalized contaminant burden is comparable between different blubber depths and locations in large whales (Gauthier *et al.* 1997). Data for right whales are limited to only two studies (Woodley *et al.* 1991; Moore *et al.* 1998). These data show a range of total PCBs of 80 to 1000 ng/g wet weight i.e., in the parts per billion range. No obvious geographic trends were evident in samples from South Africa, South Georgia, Cape Cod Bay USA and Bay of Fundy Canada (Moore *et al.* 1998). In contrast, most odontocete (i.e., toothed whales, porpoises and dolphins) values were in the parts per million range (Aguilar and Borrell 1996). Organic chemical contaminants have been regarded as of less significance for mysticetes than odontocetes and are not considered primary factors in slowing the recovery of any stocks of large whale species (O'Shea and Brownell 1994). This is especially true for planktivorous baleen whales such as right whales, given their lower accumulated contaminant burdens as compared to other marine mammals. However, assessment of contaminant body burden ignores toxic non-halogenated aromatic hydrocarbons (polynuclear aromatic hydrocarbons: PAH) from crude oil and combusted fossil fuels that do not bioaccumulate. Such compounds are metabolized, induce their effects and are mostly excreted. Contaminant impact is therefore insufficiently assayed by blubber burden analysis of parent compounds alone.

## **G.6 Underwater Explosive Activities**

Although no evidence conclusively links military activities in the North Atlantic to impacts on right whales, activities such as underwater explosions in this ocean basin have the potential for disturbing, injuring, or killing these and other whales.

In early 1996, six right whale deaths were documented. Five of these (one attributed to a ship strike) occurred in waters adjacent to Southeast U.S. (SEUS) critical habitat. Navy facilities adjacent to the critical habitat use offshore areas for gunnery exercises. Because several of the carcasses were found near a Navy gunnery range, it was suspected that some deaths were related to underwater explosions, and there was concern that Navy activities may have been involved in some deaths. However, no such link was established.

As described in Appendix A, the Navy has consulted with NMFS under Section 7 of the ESA on the potential effect of some of its operations on protected species. In addition, all Navy operations that introduce loud sounds into the marine environment are subject, under the MMPA, to application for and provision of small take letters of authorization from NMFS. The Navy has made a number of significant modifications to its operations to facilitate protection of right whales in their critical habitat in the SEUS. The NMFS and Navy both understand the need to continue to keep an open dialogue, or possible formal or informal Section 7 consultations, with regard to Navy operations and to evaluate ways to mitigate possible environmental impacts of the operations throughout the eastern seaboard.

### **G.7 Climate and Ecosystem Change**

There is a close linkage between right whale foraging and the physical forcing processes that concentrate prey in the oceanic environment (Kenney *et al.* 2001). Interannual, decadal, and longer time-scale variability in climate can alter the distribution and biomass of prey available to right whales. For example, decade-scale climatic regime shifts have been related to changes in zooplankton in the North Atlantic (Fromentin & Planque 1996). Decadal trends in the North Atlantic Oscillation (Hurrell 1995) can affect the position of the Gulf Stream (Taylor *et al.* 1998) and other circulation patterns in the North Atlantic that may be important to right whales. The effects of climate-induced shifts in productivity, biomass, and species composition of zooplankton on the foraging success of right whales has received little attention. Such shifts in community structure and productivity may alter the distribution and occurrence of foraging right whales in coastal habitats, as well as affecting their reproductive potential.

### **G.8 Commercial Exploitation**

Although initially the single major cause of decline in North Atlantic Right Whales, there has been little hunting of right whales this century; the last known catch occurred in 1951 at Trinity Bay, Newfoundland (Mead 1986). Catches in the eastern North Atlantic in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries were made off Iceland, Scotland and Ireland (Collet 1909; Brown 1976); these catches were made largely by Norwegian whaling operations, and it is likely that they irreversibly damaged or extirpated this stock. Unlike in the North Pacific, there is no evidence that illegal whaling operations occurred in the North Atlantic.

## **H. Conservation Measures**

Right whales were protected by the 1931 Convention for the Regulation of Whaling, which took effect in 1935. They have been protected from commercial whaling by the IWC and its implementing convention since 1949. In U.S. waters, right whales are protected by the MMPA and the ESA. The northern right whale (which included both the North Atlantic and North Pacific species) was listed as endangered under the Endangered Species Conservation Act in June 1970 (35 FR 8495), the precursor to the ESA. It was subsequently listed as endangered under the ESA in 1973, and listed as depleted under the MMPA in the same year.

The ESA provides authority to the Secretary of Commerce for protecting most endangered marine species, including right whales. The National Marine Fisheries Service (NMFS) has lead responsibility for developing and implementing a recovery program for this species.

### **H.1 Establishment of Regional Recovery Plan Implementation Teams**

The ESA provides authority to the Secretary of Commerce to establish teams to, among other things, review recovery activities and provide recommendations to NMFS on improving such activities. Two such teams have been formed: one in the southeastern United States and one in the northeastern United States.

#### **H.1.1 Southeastern U.S. Implementation Team (SEIT) for the Right Whale Recovery Plan**

In August 1993, the Southeastern U.S. Right Whale Recovery Plan Implementation Team was formed. The team consists of representatives from the Georgia Department of Natural Resources (currently, Vice Chair); Florida Fish and Wildlife Conservation Commission (formerly the Florida Department of Environmental Protection, and the current vice-chair); NMFS/Southeast Fisheries Science Center and Southeast Regional Office; Navy; Georgia Ports Authority; Canaveral Port Authority; Glynn County Commission, Glynn County, GA; Georgia Environmental Policy Institute; U.S. Army Corps of Engineers; U.S. Environmental Protection Agency (EPA); Port of Fernandina, Fernandina, Florida; and the US Coast Guard (USCG).

Since its inception, the SEIT has met regularly and has been active in a number of areas. Among other things, the SEIT was instrumental in developing a system of aircraft surveys and communication systems that alert mariners to the presence of right whales in the SEUS in real time. On numerous occasions in recent years, aircraft observers were able to contact and divert ships on direct courses for right whales.

Two agencies represented on the SEIT, the Georgia Department of Natural Resources and the USCG, implemented a local Notice to Mariners broadcast about right whale calving grounds. This notice is broadcast four times daily by the USCG on VHF radio. A slightly longer version is published in the local Weekly Notice to Mariners. This notice may also be published daily along with the tides and weather in regional newspapers, and is carried by the Army Corp of Engineers as a part of its annually distributed tide charts. The Annual Notice to Mariners also provides the same information.

The SEIT has coordinated a number of efforts to educate mariners about the threat of ship strikes in right whale habitat. For example, the Team or its participating agencies have

developed brochures and pamphlets on whales, manatees and turtles, which are being distributed regionally. As a group, the Port Authorities prepared a series of posters, distributed by the harbor pilots when they board a vessel for navigation, which describe the times right whales are in their waters.

A quarterly newsletter was developed to help increase the effectiveness of recovery efforts. The newsletter is edited by members of the Team. Contribution to the newsletter is open to anyone actively involved in right whale conservation efforts, and has included ship operators, harbor pilots, port authorities, fishermen, educators, scientists, managers, policy makers, non-governmental organizations and other concerned citizens. Relevant information from areas other than the southeastern calving areas (e.g., Bay of Fundy field season summaries) are also included. The first newsletter was published in August 1994 and has been published regularly since.

In addition, the Team has addressed and/or provided recommendations to NMFS regarding right whale research in the SEUS, additional measures to reduce the possibility of ship strikes, development of safe operating procedures for large vessels transiting right whale habitat, minimum vessel approach distances, and restrictions of hazardous fishing gear in right whale calving areas.

#### **H.1.2 Northeastern U.S. Implementation Team (NEIT) for the Right Whale Recovery Plan**

The Northeast Implementation Team (NEIT) was established in 1994. The Team is coordinated by the National Marine Fisheries Service, Northeast Regional Office. The Team was created to implement recovery tasks for both the North Atlantic right whale and the humpback whale. Composition of the Team and its committee of technical advisors consists of a diverse group of individuals representing major Federal and State agencies whose activities could affect the survival of these endangered large whale species. It also includes other non-governmental organizations such as academic researchers, conservation organizations, as well as interested private individuals. Presently, membership consists of representatives from: Canada's Department of Fisheries and Oceans, Maine Department of Marine Resources, Marine Mammal Commission, Massachusetts Coastal Zone Management, Massachusetts' Division of Fish and Wildlife, Massachusetts' Port Authority, NMFS, New England Fishery Management Council, Stellwagen Bank National Marine Sanctuary, U.S. Army Corps of Engineers, USCG, U.S. Navy and U.S. EPA. The Maine Department of Marine Resources and the U.S. Navy are the latest Team members, joining the Team in 1998.

Some accomplishments of the Team include completion of a status report and plan of activities for protecting right and humpback whales in Massachusetts and Cape Cod Bays in cooperation with the EPA, and implementation of a monitoring program for one of the largest waste water treatment plants in the United States.

The Team has two Technical Advisory Groups, a scientific group and a shipping industry group. The scientific group provides expertise on the biology and behavior of whales while the shipping industry group provides guidance on vessel and port operation.

The Team established two subcommittees, one on ship strikes and one on habitat. The Habitat Subcommittee that was originally established at the Team inception languished and was reestablished in March 1997. The Habitat Subcommittee has placed emphases on identifying human impacts to right whale habitats and critical elements of those habitats to facilitate the Team's goal of protecting areas critical to right whale recovery.

Among other things, in 1997, the Habitat Subcommittee proposed the development of a right whale habitat model for the entire east coast. Two meetings were conducted to determine the scope of work necessary for the task and to develop a preliminary list of the model's elements, including one for the Great South Channel area. The predictive model could be used as a management tool, if it were successful in identifying whale occurrence. This information would be used to aid shipping traffic in avoiding right whales.

With regard to ship strikes, a joint effort was initiated in 1998 by resource shareholders of the northern U.S. east coast to produce an avoidance training/education video targeted at merchant mariners. Agency members include the USCG, U.S. Navy, Canadian Department of Fisheries and Oceans, International Fund for Animal Welfare, Gulf of Maine Council, and Massachusetts Environmental Trust. The video was completed in May 1999. An initial distribution plan included vessels utilizing major ports in or adjacent to critical habitat areas along the eastern seaboard.

A Ship Strike Subcommittee workshop was held on 11 May 1998 to discuss concerns about increasing numbers of high-speed vessels operating off New England and potential interactions with whales. The meeting was co-sponsored by NOAA's Stellwagen Bank National Marine Sanctuary, New England Aquarium and the NEIT. The impetus of the meeting was the launching of a new high-speed ferry between Bar Harbor, Maine and Yarmouth, Nova Scotia. One outcome was the creation of a working group to determine whale concentration in the Bay of Fundy. The owner of the high-speed vessel agreed to enter into a partnership agreement to fund an analysis, including GIS plots, of the occurrence of endangered large whales on or near the ferry route. Analysis will examine the times and areas of potential interactions. Likewise, Bay Ferries (owner and operator of a high speed ferry service) agreed to have an observer on board to record whale observations. It is important to emphasize that all right whales that visit the Bay of Fundy must cross the track of the Bar Harbor-Yarmouth ferry when coming in and going out; this obviously creates a risk of collisions.

Another joint effort, started in May 1999, is developing a program to identify voluntary measures mariners could take to reduce the likelihood of ship strikes. A funding partnership was established among the NMFS, the NEIT, Georgia Department of Natural Resources, Marine Mammal Commission, and the Canadian Department of Fisheries and Oceans. The SEIT voted in October 2000 to have the NEIT Shipstrike Subcommittee (subsequently elevated to a full committee) co-chairs represent the SEIT as part of the national committee to develop options to prevent collisions between ships and right whales. The SEIT also nominated a member to serve as co-chair on the committee. The Committee co-chair, under contract with NMFS, International Fund for Animal Welfare and others, held a number of meetings along the eastern seaboard with shipping industry and agency representatives, culminating in an April 2001 workshop on the issue. The contractor submitted recommendations to both implementation teams and recommendations on specific management options were subsequently forwarded to NMFS by the Teams.

## **H.2 Steps Taken to Reduce the Threat of Fishing Gear Entanglement**

### **H.2.1 List of Fisheries**

Under the MMPA, NMFS is required to develop a List of Fisheries that classifies all U.S. commercial fisheries into one of three categories based on the level of marine mammal deaths



and serious injuries that occur incidental to the fishery<sup>2</sup>. The categorization of a fishery in the List of Fisheries determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. A notable change made to the 1997 List was combining the New England inshore and offshore lobster pot fisheries into one fishery, and a change in its classification from a category III (remote likelihood of serious injury or mortality) to a category I (frequent serious injury or mortality) status. The re-classification resulted from entanglement records indicating that 0.2 right whales per year are seriously injured or killed incidental to the Atlantic lobster pot fishery.

## **H.2.2 Take Reduction Teams**

The 1994 amendments to the MMPA required NMFS to establish teams comprised of stakeholder groups to determine ways to reduce serious injury and mortality of strategic stocks of marine mammals, including threatened or endangered species, that interact with category I or II fisheries. The Take Reduction Team assists NMFS in developing a Take Reduction Plan. The immediate goal of the Take Reduction Plan is to reduce incidental mortality or serious injury to the marine mammal stock's potential biological removal level (PBR) within six months of the plan's implementation. The longer term goal is to reduce serious injuries and mortality to an insignificant level approaching a zero mortality and serious injury rate (Zero Mortality Rate Goal, or ZMRG).

### **H.2.2.1 Atlantic Large Whale Take Reduction Team and Plan**

In August 1996, NMFS formed the Atlantic Large Whale Take Reduction Team to reduce the incidental mortality and serious injury of three endangered species of whales (northern right, fin, and humpback) as well as to provide conservation benefits to a fourth non-endangered species due to incidental interaction with the following fisheries: the Gulf of Maine/U.S. mid-Atlantic lobster trap/pot fishery, the mid-Atlantic coastal gillnet fishery, the southeastern U.S. Atlantic shark gillnet fishery, and the Gulf of Maine sink-gillnet fishery (the names of some of these fisheries as listed in the List of Fisheries have changed and representatives of additional fisheries, such as the newly-defined Atlantic mixed species trap/pot fishery, have been added to the team). The Team prepared a plan, and although the Team reached agreement on a number of needed actions, it failed to reach consensus on all measures. Nonetheless, the plan was forwarded to NMFS in February 1997.

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<sup>2</sup> *Category I fishery* means a commercial fishery determined by the Assistant Administrator to have frequent incidental mortality and serious injury of marine mammals. A commercial fishery that frequently causes mortality or serious injury of marine mammals is one that is by itself responsible for the annual removal of 50 percent or more of any stock's potential biological removal level. *Category II fishery* means a commercial fishery determined by the Assistant Administrator to have occasional incidental mortality and serious injury of marine mammals. A commercial fishery that occasionally causes mortality or serious injury of marine mammals is one that, collectively with other fisheries, is responsible for the annual removal of more than 10 percent of any marine mammal stock's potential biological removal level and that is by itself responsible for the annual removal of between 1 and 50 percent, exclusive, of any stock's potential biological removal level. *Category III fishery* means a commercial fishery determined by the Assistant Administrator to have a remote likelihood of, or no known incidental mortality and serious injury of marine mammals. A commercial fishery that has a remote likelihood of causing incidental mortality and serious injury of marine mammals is one that collectively with other fisheries is responsible for the annual removal of: (1) Ten percent or less of any marine mammal stock's potential biological removal level, or (2) More than 10 percent of any marine mammal stock's potential biological removal level, yet that fishery by itself is responsible for the annual removal of 1 percent or less of that stock's potential biological removal level.

NMFS considered the plan submitted by the team and issued a proposed rule in April 1997 and an interim final rule in July 1997 (62 FR 39157) to implement the plan. As provided in the interim final rule, NMFS implemented the provisions of the plan, including (1) formation of a fishing gear advisory group; (2) research on potential fishing gear modifications to determine ways to reduce entanglement and facilitate release following entanglement; (3) a fishermen outreach and education program; (4) expansion of the disentanglement network; (5) hiring a large whale coordinator in Maine (a state in which much of the gear restrictions were heavily opposed); (6) continuation and refinement of the NE aircraft survey program; (7) time/area closures; (8) time/area – specific restrictions on gear deployment.

On February 16, 1999, NMFS published a final rule (64 FR 7529) implementing the final take reduction plan. The final plan included minor modifications to the interim final rule. NMFS has generally reconvened the team on an annual basis since 1997 to further revise the plan. NMFS has amended the rule implementing the plan several times to incorporate additional measures, including an interim final rule to provide additional gear restrictions on December 21, 2000 (65 FR 80368). In January 2002, NMFS published three rules that (1) make further modifications to commercial fishing gear (67 FR 1300, January 10, 2002; see also 67 FR 15493, April 2, 2002; 67 FR 59471, September 23, 2002), (2) establish restricted areas based on annual, predictable aggregations of right whales (67 FR 1142, January 9, 2002), and (3) establish a system for restricting fishing in areas where unexpected aggregations of right whales are observed (67 FR 1133, January 9, 2002; see also 68 FR 51195, August 26, 2003).

NMFS is currently preparing an Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act to consider alternatives for possible additional modifications to the take reduction plan to meet the goals of the MMPA (see the notice of intent to prepare an EIS at 68 FR 38676 (June 30, 2003)).

#### **H.2.2.2 Atlantic Offshore Cetacean Take Reduction Team and Plan**

In May 1996, NMFS established the Atlantic Offshore Cetacean Take Reduction Team to address incidental take of several marine mammal species in offshore fisheries, primarily the offshore driftnet fishery for swordfish and the longline fishery for tunas. Marine mammals taken in these fisheries include large whales, common dolphins (*Delphinus delphis*), white-sided dolphins (*Lagenorhynchus acutus*), pilot whales (*Globicephala* spp.) and various species of beaked whales. The team submitted a draft Plan to NMFS in November 1996. Among other things, the Team proposed various measures to protect right whales that primarily involved restrictions or modifications of the drift gillnet and longline operations.

Based in part on the Team's recommendations and concerns about right whales, the offshore drift gillnet fishery for swordfish, sharks and tuna was closed. Two of the three fisheries which were the focus of this Team's efforts (the drift gillnet and pair trawl fisheries for swordfish, tuna, and shark) no longer exist, and the third fishery (the pelagic longline fishery targeting the same species) has been substantially altered by a series of closures enacted for purposes of target species and bycatch species management (such as billfish and sea turtles). In addition, the recommendations submitted by the take reduction team regarding operation of the pelagic longline fishery were partially addressed under a Fishery Management Plan for Highly Migratory Species (64 FR 29090, May 28, 1999). Therefore, NMFS decided to dissolve the Team until such time as sufficient data are available on marine mammal bycatch in the pelagic longline fishery under the new

management regime. However, no right whale interactions have been documented in this fishery.

### **H.3 Efforts to disentangle right whales**

The 1991 recovery plan called for establishment of a marine mammal disentanglement program. NMFS established a team of scientists from the Center for Coastal Studies and the New England Aquarium to respond to all marine mammal entanglements, with an emphasis on right and humpback whale entanglements. The program was purely voluntary when it originated in 1984 and remained voluntary until a contract with NMFS was established in September 1995. The contract for 1996-1998 was restricted both by availability of NMFS resources and in scope. In 1999 and 2000, a contract was provided by NMFS to cover all disentanglement activities. In 2001, the activities were covered by several sources and, at the time of this writing, attempts are being made to secure NMFS funding for the foreseeable future.

Emergency response involves (1) multi-agency and multi-organization communication to locate, monitor, and safely disentangle marine mammals; (2) development and maintenance of an entanglement database and provision of data to users; and (3) development of regional protocols and plans, including outreach to the general public. When whales become entangled, judgements must be made as to the efficacy and merits of disentanglement. Experience indicates that disentanglement is best undertaken by trained and experienced personnel, with appropriate protocols for the procedure as well as the associated data collection.

The current disentanglement effort consists of one primary team and basic field support in the Bay of Fundy, Gulf of Maine, the mid-Atlantic, and Georgia/Florida. The program covers nearshore disentanglement events along the eastern seaboard, although the team has the capability to be deployed in some offshore locations. There are other limitations; for example, the northern Gulf of Maine/Bay of Fundy and Georgia/Florida field stations are operational only when biologists are conducting seasonal whale research, and even then disentanglement response relies on the timely transfer of the team and their equipment to the entanglement site. In the southeast U.S., trained biologists are available to assist and disentanglement equipment caches have been established at key locations.

Over the last 15 years, an average of about four to eight right whales have been reported entangled each year in U.S. and Bay of Fundy waters. Of these, numerous whales have been completely or partially disentangled. A number of lightly entangled whales freed themselves before intervention could occur. However, one right whale was severely entangled and in October 1999 died as a result of the entanglement. Another, reported in 1998, was completely disentangled but had sustained major injuries from a prior entanglement, and is believed to have died even though all gear was removed. Attempts were made to disentangle a severely entangled right whale in 2001. The gear was affixed with satellite transmitters and its movements were tracked for several weeks. Although the actual fate of this animal is not known, signals from the transmitter suddenly stopped and the whale has not been re-sighted. It is highly probable that it died from wounds it received from the entanglement.

### **H.4 Efforts to Reduce Mortality or Disturbance from Ship Activities**

#### **H.4.1 Vessel Approach Regulations**

Disturbance to whales was identified in the 1991 recovery plan as one of the principal human-related factors impeding right whale recovery. Often where human activities co-occur with right whales off the U.S. east coast, there is potential for disturbance of right whales.

To minimize human-induced disturbance NMFS published a proposed rule on August 7, 1996 restricting vessel approach to right whales (61 FR 41116). These regulations proposed to prohibit all approaches within 500 yards (460m) of any right whale, whether by vessel, aircraft or other means. Exceptions exist for emergency situations and where certain authorizations are provided. The regulations are consistent with Massachusetts' approach regulations for right whales.

Following public comment, an interim final rule (62 FR 6729) was published on February 13, 1997 codifying the regulations. With certain exceptions, 50 CFR 224.103 prohibits both boats and aircraft from approaching any right whale closer than 500 yards. Exceptions for closer approach are provided when (1) compliance would create an imminent and serious threat to a person, vessel, or aircraft; (2) a vessel is restricted in its ability to maneuver around a 500 yard perimeter of a whale; (3) a vessel is investigating or involved in the rescue of an entangled or injured right whale, or (4) the vessel is participating in a permitted activity, such as a research project. If a vessel operator finds that he or she has unknowingly approached closer than 500 yards, the rules require that a course be steered away from the whale at slow safe speed.

#### **H.4.2 Aircraft Surveys in the Southeastern United States**

To help reduce the possibility of ship strikes, the Southeast Implementation Team developed a system to alert area ship traffic to the presence of right whales. As noted earlier, the Team and its member agencies and organizations developed advice for vessel operators on ways to detect and avoid right whales, and distributed brochures, fliers, videos and other information on right whales and the threat that vessel traffic poses to them. The central feature of the system has been a jointly funded aerial survey program designed to obtain accurate, current information on the locations of whales. Continuously updated sighting information from survey teams is immediately relayed to area mariners to help them avoid encountering whales.

Surveys were initiated in the waters off the SEUS in fall 1993 and have continued each year since. Survey lines occur at 3 nautical mile intervals throughout, and seaward as well as to the north and south of, critical habitat. Sighting locations are passed from the aircraft to centralized locations operated by the USCG and Navy. These groups in turn provide the information through a number of real time media, including USCG Broadcast Notice to Mariners, NAVTEX (the USCG international communication system), and NOAA Weather Radio. If a survey locates whales within a specified distance of a navigational channel, vessels are requested to proceed at minimum safe operational speeds and communicate locations so other vessels can avoid the whales. Design and execution of the survey program has been a cooperative effort by a number of Federal and State agencies. Support and personnel are provided by the USCG, the Navy, the Army Corps of Engineers, the States of Georgia and Florida, and NMFS. In recent years, the Navy has become the central repository and dispenser of sighting location information used for the communication network. Data are quality-controlled and entered into a GIS by the Florida Fish and Wildlife Conservation Commission, who are analyzing sighting data, Mandatory Ship Reporting data, and various environmental correlates to develop a predictive model for right whales. A risk assessment model is also being developed. These procedures will be continually reviewed and improved by the SEIT.

#### **H.4.3 Aircraft Surveys in the Northeastern United States**

Using the SEUS aircraft survey program as a model, efforts were initiated in 1997 to develop a similar program in Cape Cod Bay (CCB) and the Great South Channel (GSC) in late winter and early spring. The program is a cooperative effort by NMFS, the USCG, Massachusetts Division of Marine Fisheries, the Massachusetts Environmental Trust, the Center for Coastal Studies, the Navy and MASSPORT (the Boston port authority), the Stellwagen Bank National Marine Sanctuary, National Weather Service, the US Army Corp of Engineers, Cape Cod Canal, Wheelock College, and New England Aquarium. Representatives from these groups meet regularly for coordination of the program.

In 1997-1999, surveys supported by NMFS and the State of Massachusetts were conducted to cover peak abundance periods and were flown principally between January and March in CCB, and in the GSC between January and early July and in several other key areas, as well. Sources of information for the survey network include: (1) marine mammal lookouts posted during USCG vessel operations and from USCG pilots; (2) ship-based sightings by the Center for Coastal Studies during their studies of right whale feeding and behavior in CCB and when they are responding to reports of whale entanglements; and (3) research and other ships operated by the NMFS and the State of Massachusetts.

Sightings from aerial survey platforms, right whale researchers, and multiple sources are reported to NMFS' Northeast Regional Office. NMFS confirms the reports and synthesizes them. These data are plotted using a GIS with sightings grouped and 'circled' with a buffer zone. These right whale sighting advisories, or 'alerts', are disseminated to cooperators via an automated facsimile system and posted to several web page locations. The USCG issues Broadcast Notices to Mariners and via NAVTEX. NOAA Weather Radio provides geographic and positional data on the sightings periodically; the Cape Cod Canal Traffic Controllers contact ships and provide positions and a radius for each sighting. Each sighting report generally has a 24-hour life unless it is updated later in the day. Shipping agents, pilots and port authorities disseminate the information by voice or paper copy of the faxed advisories to inbound and outbound shipping traffic as appropriate. Maps, positions and radii, and reporting source information are posted to the Wheelock College, Whalenet, website. Historic sighting advisory reports are also maintained on this site. Several other web pages including NMFS's Northeast Fisheries Science Center (NEC), NMFS's Northeast Regional Office (NER) and the Massachusetts Executive Office of Environmental Affairs port have the most current maps and link to the more complete Whalenet site. A NMFS Inquiry Line maintained at the NER provides right whale sighting information and copies of the right whale faxes if requested by callers. Notifications to individual ships, commercial fishing and military vessels are made by voice from the aircraft when observed vessels are transiting close to a whale. In addition, these surveys have provided sightings of entangled and floating right whales, and provide photo identification data for numerous studies. The NEIT Ship Strike Sub Committee initiated action to have information on right whales and related advisory text added to the Cape Cod Canal tide tables in 1998 and 1999.

Current plans are to continue the surveys into the foreseeable future. A partnering document, the initiation of which began with the Georgia Department of Natural Resources, has been prepared to identify cooperative efforts in support of the program with NMFS, the USCG, the Massachusetts Department of Fisheries and Wildlife, the Center for Coastal Studies, the National Weather Service, the Army Corps of Engineers, Wheelock College, the Stellwagen Bank National Marine Sanctuary, the New England Aquarium, the Massachusetts Environmental Trust, the Massachusetts Port Authority,

and the Navy. The 1997 Partnering Document included 12 partners. In 1998, several other groups such as shipping agents pilots, whale watch vessel operators and a high-speed ferry operator were added as cooperators. The partnering document will be prepared each year and an increasing number of cooperators is expected each year.

It should be noted, however, that while dedicated aircraft surveys may be the best available means to attempt to alert mariners about the presence of right whales, these programs have a number of limitations. For example, they are costly to implement. It is possible that these are resources that might be better spent on other activities. Also, the surveys are limited by weather and surveys can be conducted only in daylight and under the best of survey conditions. In addition, it is likely that, even under good conditions, many whales are missed by observers, especially since only those whales at or near the surface can be seen. Nonetheless, until effective alternatives are identified, the surveys are expected to continue.

#### **H.4.4 Updating Navigational Publications**

To help ensure safe navigation in coastal waters in the United States, the National Ocean Service publishes and periodically updates nautical charts and a series of regional books called *U.S. Coast Pilots*. These are basic references on regional environmental conditions, navigation hazards, and rules. In U.S. waters, all ship's captains are required to carry *Coast Pilots*.

Efforts in 1997 and 1998 were directed at updating information contained in the *Coast Pilots*. *Coast Pilots* covering the entire eastern United States have been or will soon be updated to include information on the status of right whales, the times and areas that they occur, the threats posed to whales by ships, and advice on measures mariners might take to avoid hitting right whales. For example, it notes that mariners should not assume that whales will avoid oncoming vessels, and suggests that lookouts be alert for right whales in critical habitats, that mariners listen for broadcasts reporting recent right whale sightings locations, and that reduced speeds be used when near whales or traveling in key habitats at night or during other conditions of poor visibility. Also, updated information regarding right whale critical habitat and regulations about approaching right whales will be published on nautical charts when they are re-printed. Efforts to ensure that these navigational aids were updated to include information on right whales was done cooperatively by the NEIT and SEIT, the International Fund for Animal Welfare, the Marine Mammal Commission, and NMFS.

Starting in late 1997, NMFS provided language similar to that included in the *Coast Pilots* about right whale vulnerability to ship strikes to the National Imagery and Mapping Agency (NIMA), which annually publishes a *Notice to Mariners*. The information appeared in the January 1998 issue, and has been updated annually since. NMFS also provided information to NIMA for inclusion in their international navigation publication, *Sailing Directions*, which discusses and provides precautions primarily focused on right whale habitat in Canadian waters. This publication is updated annually.

#### **H.4.5 Mandatory Ship Reporting System**

In late-1997 and early-1998, NMFS and the National Oceanic and Atmospheric Administration, the USCG, and the International Fund for Animal Welfare jointly developed a proposal for submission to the International Maritime Organization (IMO) requesting implementation of a mandatory ship reporting system in right whale habitats. The proposal received endorsement from the USCG, the Marine Mammal Commission,

and other agencies and organizations. It was submitted by the USCG to, and endorsed by, the IMO in December 1998 and the system became operational in July 1999. A portion of the system in the Northeast, which encompasses right whale critical habitat in Cape Cod Bay and the Great South Channel, operates year round. A second portion includes right whale critical habitat off the Southeast U.S. and operates from 15 November to 15 April each year. The system obligates all commercial ships greater than 300 gross tons in these areas and times to call into a shore-based station (primarily by satellite-linked communication), thereby prompting a return message which describes right whale vulnerability to ship strikes, provides information on how collision could be avoided, and right whale sighting locations. Information from reporting ships is compiled in a data base. Thus, the system provides information on right whales directly to mariners as they enter right whale habitat, and provides a means to obtain information on ship traffic volume and routes to assist in identifying measures to reduce future ship strikes. It is jointly funded by the USCG and NMFS, and administered primarily by the USCG.

#### **H.4.6 International Safety Management Code**

The International Fund for Animal Welfare and the NEIT identified to NMFS an opportunity to educate mariners through routine safety inspections of domestic and foreign vessels for vessel operation and human safety while in U.S. waters. In late 1997, NMFS and the USCG began a dialog about the incorporation of protected marine species issues, including northern right whales, in required safety manual documents developed by ship owners and companies. By late 1998, the USCG had included language in policy documents regulating the implementation of the International Safety Management Code, and was providing protected marine mammal information in its training courses for inspectors and auditors.

#### **H.4.7 Educational Materials and Outreach**

A number of agencies and organizations have collaborated on developing brochures, pamphlets, and informational papers to educate mariners about the vulnerability of right whales to ship strikes. NMFS has published magazine articles directed to the shipping industry. Also, as noted above, a video on this subject was prepared and is being distributed to the shipping industry.

#### **H.5 Strandings and Necropsies**

Given the importance of obtaining life history data and information on the sources of human impacts, and the limited opportunities to collect these data, gathering the maximum amount of information from stranded whales is essential. In cooperation with local and State participants NMFS coordinates the U.S. Marine Mammal Stranding Network which responds to hundreds of strandings each year. Generally, response to, and data collection from, stranded right whales has improved substantially in recent years, although there is also room for improvement. Standardized protocols have been developed to help ensure that the best possible information is collected from each event. However, the protocols and the systems used to gather and analyze data should be reviewed and steps taken to ensure that maximally useful data are obtained.

#### **H.6 Coordination of Federal agency recovery activities under the Endangered Species Act**

Under section 7 of the ESA and implementing regulations at 50 CFR 402.14, Federal agencies are required to review their actions and consult with NMFS on any action that

may affect listed species or critical habitat for species under NMFS' jurisdiction (including right whales). Many of the recovery activities for all endangered and threatened species are implemented through consultations between NMFS and other Federal agencies. As a result of these consultations, NMFS issues either a letter of concurrence that any activity is not likely to adversely affect a species or critical habitat, or a Biological Opinion for activities likely to adversely affect a species or critical habitat. A Biological Opinion indicates if the activity is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat and, if so, provides reasonable and prudent alternatives to the activity. In those cases where NMFS concludes that an action (or implementation of any reasonable and prudent alternatives) and the resultant incidental take of listed species is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat, NMFS specifies reasonable and prudent measures necessary and appropriate to minimize effects of the action on the species of concern. Significant points of the most recent consultations can be found in Appendix A.



## II. RECOVERY STRATEGY

In light of the low population size, possibly declining status, life history of the species, and high rate of mortality from anthropogenic causes, the most immediate need for the North Atlantic right whale is to reduce or eliminate human-related deaths and injuries. At present, these result primarily from ship collisions and fishing gear entanglement. Actions to reduce ship collisions include continuation of a “sighting advisory system,” vessel traffic management, mandatory ship reporting systems, development of alternative methods to predict right whale occurrence and distribution, and studies of the effects of ship noise on whale behavior. Actions regarding fishing gear interactions include modification of fishing operations and gear, reporting requirements and followup, and disentanglement of whales from fishing gear. Effectiveness of these protection measures for both shipping and fishing gear entanglement needs to be monitored, education and outreach programs need to be continued and improved, and regulations need to be stringently enforced. In addition, the development of demographic recovery criteria is a high priority action that needs to be completed quickly.

Secondary, but still high priority, needs involve other actions of importance to the species’ management, including characterization and monitoring of important habitat, and protection of this habitat; and identification and monitoring of the status, trends, distribution and health of the species. Habitat-related actions include characterization and monitoring of habitat; the use of GIS to analyze whale and vessel occurrence and distribution (including the patterns of strandings), and to prepare predictive models of whale occurrence; analysis and revision, if supported, of critical habitat; and studies on food requirements and resources. Monitoring includes assessing status and trends, and distribution; maintaining a photo-identification database; assessing demography, stock structure, and health; and maximizing responses to strandings.

Third priority needs include studies on the effects of other potential anthropogenic mortality (such as coastal development, anthropogenic noise, pollutants, whale watching, and potential oil and gas exploration) and, if these are found to be threats, ensuring that they are addressed; and genetic studies to assess population structure and diversity.

All of the above actions require close coordination with other Federal, State, international, and private entities to ensure that research and recovery efforts are conducted efficiently and effectively.

### III. RECOVERY GOALS AND CRITERIA

The ultimate goal of this recovery plan is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants (List) under the ESA. The intermediate goal is to reclassify the species from endangered to threatened.

Based on the current population size of North Atlantic right whales, which has remained at approximately 300 animals, the continued human-caused threats to the species, and the whale's life history, North Atlantic right whales face a high risk of extinction into the foreseeable future. As a result, the criteria identified here for reclassification from endangered to threatened are not likely to be met for decades or longer. Although the criteria included in this plan will likely not be applicable in the near future, the agency has developed a set of rigorous recovery criteria (for reclassifying the species as threatened) based on existing knowledge of the population and available scientific tools. It is anticipated that the following criteria will be revisited; in addition, delisting criteria will be incorporated when the population has begun to recover such that conditions now distant and hypothetical (such as recovery trends and future threats) will be apparent.

Recovery criteria must include the elimination of threats to the species as well as measures of demographic health. Both sets of criteria serve as checks on one another — one set of criteria requires evidence that the threats to North Atlantic right whales have been eliminated or controlled and are not likely to recur, and the other set of criteria requires evidence that the population status of North Atlantic right whales has improved in response to the reduction of threats.

#### *A Framework for Recovery Criteria*

Recovery criteria in this plan are partially derived from a workshop NMFS convened in February 2001 to develop reclassification criteria for endangered large whale species (Angliss et al. 2001). The workshop developed, and NMFS applies here, the following guidelines for recovery criteria:

- A probabilistic threshold is appropriate to describe the risk of extinction;
- A large cetacean species shall no longer be considered endangered when, given current and projected conditions, the probability of quasi-extinction<sup>3</sup> is less than 1% in 100 years;
- A large cetacean species shall no longer be considered threatened when, given current and projected conditions, the probability of becoming endangered is less than 10% in a period of time no shorter than 10 years and no longer than 25 years. The period depends upon the precision of the data on population abundance and trend information, the time it takes the agency to respond to a potential change in the status, and the time it will actually take the species to recover.
- Recurrence of threats that brought the species to the point that warranted listing and current threats to the species have been addressed. The ESA requires that any determination of the status of a species consider five potential sources of threats (or five “factors”) affecting its continued existence:

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<sup>3</sup> Quasi-extinction is defined (Ginzburg et al. 1982) as a small, critical population threshold whose lower boundary may be unacceptable for the continued survival of a species. This could be the population size at which factors such as demographics, inbreeding depression, or behavioral constraints prohibit survival.

- (a) the present or threatened destruction, modification or curtailment of its habitat or range;
- (b) overutilization for commercial, recreational, scientific, or educational purposes;
- (c) disease or predation;
- (d) the inadequacy of existing regulatory mechanisms; and
- (e) other natural or manmade factors.

Each recovery plan and any consideration to change the listing status of the species must address these five areas.

NMFS is currently re-evaluating the risk of extinction that could be used as a threshold between threatened and endangered status or between threatened and recovered to a level that continued protection under the ESA is not longer necessary (delisting). The evaluation is expected to continue for at least another 2 years. The results of that evaluation may be different than the risks of extinction identified by the large whale workshop (Angliss et al. 2001), and in such a situation, NMFS would revise the framework criteria used in this recovery plan. However, the framework criteria described in Angliss et al. (2001) are used in this recovery plan because they represent the best information currently available to characterize the status of large whales.

#### **A. Reclassification to Threatened**

North Atlantic right whales may be considered for reclassifying to threatened when all of the following have been met:

1. The population structure of right whales (including, but not limited to, such parameters as abundance, growth rate, age structure, gender ratios) is indicative of a biologically significant increasing population.

Because this is a long-lived and slow-growing species, the criteria should specifically address population structure rather than simply population numbers.

2. The population has increased for a period of 20 years at an average rate of increase of 2% per year or more.

Twenty years was determined to be a relevant time line for right whales according to the above-mentioned workshop. Twenty years is the minimum length of time necessary to carry out the following activities: determine population abundance, determine trends in abundance, determine what factors are negatively affecting the population, determine how to alleviate those factors, and implement management actions that will facilitate the recovery of the population (Angliss et al. 2001). A 2% increase is the generally accepted minimum detectable rate of growth consistent with that of long-lived, large mammals.

3. All five listings factors are addressed (for thorough discussion, see Appendix C).

**Listing/Recovery Factor A: The Present or Threatened Destruction, Modification or Curtailment of a Species Habitat or Range** In order to ensure the long-term recovery needs of the North Atlantic right whale and provide adequate assurance of population stability, threats to right whale habitat or range must be reduced or removed. Habitat degradation may occur from oil spills, noise pollution from shipping or oil and gas development, dredging, and contaminants.

- Habitat degradation from oil spills, noise pollution, dredging and contaminants are not limiting the recovery of the species.

**Listing/Recovery Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes** There are no data at this time to indicate that these issues are limiting the recovery of the North Atlantic right whale. However, prior to downlisting, the effects of commercial harvest, research activities, and recreational and educational activities such as whale-watching must be considered.

- Recreational and educational activities are adequately regulated by the permitting process.
- No right whales are allowed to be harvested for commercial purposes.

**Listing/Recovery Factor C: Disease or Predation** At this time, there are no data indicating that predation is limiting right whale recovery. However, results of body condition analysis and the occurrence of skin lesions on North Atlantic right whales may be indicative of health issues within the population.

- Disease is not appreciably affecting the recovery of the species and is not likely to do so in the foreseeable future.

**Listing/Recovery Factor D: The Inadequacy of Existing Regulatory Mechanisms** Regulations may be insufficient to adequately protect the population. In particular, it may be necessary to enhance existing regulations, or promulgate new regulations to reduce or eliminate the threat of ship strikes and fishing gear entanglement.

- Adequate regulations or other means to minimize ship strikes are in place and being implemented and the criterion set forth under Factor E is met.
- Adequate regulations, gear, or other means to minimize entanglement in fishing gear exist and are being implemented and the criterion set forth under Factor E is met.

**Listing/Recovery Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence** No natural factors are known to be limiting the recovery of North Atlantic right whales at this time. The most significant threat to North Atlantic right whale recovery remains human-related mortality, most notably, ship collisions and entanglement in fishing gear. Additionally, other factors may be identified as direct or indirect threats in the future, such as habitat degradation, coastal development, undersea noise, contaminant loads (covered under Factors A-D).

- Human-caused mortality and serious injury from ship strikes and fishery interactions result in a level of mortality considered to be biologically insignificant.

Finally, to support and confirm a reclassification determination generated by the above criteria, the following criteria must also be met:

4. Given the current and projected conditions, the population has no more than a 1% chance of quasi-extinction in 100 years (see Angliss et al. 2001).

Criteria, i.e., population numbers, structure and trends, have not yet been developed; however, a top priority in the recovery action narrative of this plan is to conduct analyses to derive such criteria. These analyses should expressly

indicate the assumptions, goals, uncertainties and approximations of the model used, and include sensitivity analyses of parameters and assumptions. In addition to being useful in examining the population viability analysis, sensitivity analyses can be useful in management of the species, and subsequent revisions or updates of this recovery plan. Finally, the analysis should be peer reviewed before being accepted as criteria.

## **B. Delisting**

When NMFS has considered species such as large whales for delisting under the ESA, the world-wide abundance of that species has been thousands or tens of thousands of animals. The current abundance of North Atlantic right whales is currently an order of magnitude less than an abundance at which NMFS would even consider delisting the species. The current population dynamics indicate that North Atlantic right whales is in decline rather than recovering, and decades of population growth (at growth rates considered typical for large whales) would be required before the population could attain such an abundance. As previously provided in this section, conditions related to delisting (such as recovery trends and future threats) are now too distant and hypothetical to realistically develop specific criteria. Thus, specific criteria for delisting North Atlantic right whales are not included in this recovery plan but will be included in a future revision of the recovery plan well before the population is at a level when delisting becomes a reasonable decision.

#### **IV. RECOVERY PROGRAM**

NMFS believes that the plan should be a dynamic document and thus has focused the actions largely on those that are needed in the relative short-term. As new information is obtained, new actions will be identified and incorporated into the plan. As is the case for all plans, this plan will be reviewed periodically and the relative success of these actions in protecting right whales assessed, adjustments made or additional actions added.

All actions are to be conducted in a manner consistent with international law and the international law of the sea. In particular, all provisions of this Plan shall be applied consistently with the 1983 Presidential Proclamation on the Exclusive Economic Zone, the 1988 Presidential Proclamation on the Territorial Sea, and the 1999 Presidential Proclamation on the Contiguous Zone, and in accordance with generally recognized principles of international law, and with the treaties, conventions, and other agreements to which the United States is a party.

Although this is a national recovery plan, it is recognized that recovery actions (including research and monitoring activities) involve actions by Federal, State, and local agencies, other nations, and private organizations. For instance, many fishing regulations are regionally specific and fisheries need to be managed and regulations enforced regionally or locally. Likewise, some coast-wide activities require site-specific actions. Many of these need to be coordinated nationally, but will be conducted, or responded to, locally.

As discussed in the Conservation Accomplishment section of this plan, the Northeast and Southeast Right Whale Recovery Plan Implementation Teams recommend and help organize recovery activities at the regional level and coordinate a number of state efforts. Among these activities are coordinating aircraft surveys and the relaying whale sighting locations to mariners, helping to coordinate the storing of regional equipment caches for disentanglement, and coordinating responses to right whale strandings and carcass recovery.

The objectives of this plan are as follows:

##### North Atlantic Right Whale

- Objective 1: Minimize sources of human-caused death, injury, and disturbance.
- Objective 2: Develop demographically-based recovery criteria.
- Objective 3: Identify, characterize, protect, and monitor important habitats.
- Objective 4: Monitor the status and trends of abundance and distribution of the western North Atlantic right whale population.
- Objective 5: Coordinate Federal, State, local, international, and private efforts to implement the Recovery Plan.

## **A. Step-down Outline**

### **1. Minimize sources of human-caused death, injury, and disturbance.**

#### **1.1 Reduce ship collisions with right whales.**

##### **1.1.1 Develop and implement a ship strike reduction strategy.**

###### *“Sighting Advisory System”*

1.1.2 Continue and improve seasonal aircraft surveillance of right whale habitats and other elements of the "sighting advisory system" program.

1.1.3 Provide right whale sighting locations to mariners through broadcasts and other appropriate media.

1.1.4 When possible, notify individual ships directly when their course is likely to bring them to or near a location where a whale was sighted by the aircraft.

1.1.5 Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes.

1.1.6 While continuing to conduct surveys, standardize surveys and data collection to ensure data obtained from the surveys are of maximum use for subsequent analysis of whale distribution and abundance.

1.1.7 Establish a program for regular and timely analysis of aircraft survey data to determine seasonal whale distribution and abundance and to contribute to predictive modeling exercises of environmental correlates relative to whale distribution, whale distribution relative to ship traffic, and use in subsequent risk analysis.

###### *Vessel Traffic Management*

1.1.8 Use acoustic detection technology (e.g., “pop-up” buoys), surveys, and other technologies as available to monitor right whale occurrence and distribution in waters off the mid-Atlantic states.

1.1.9 Develop a system to encourage, collect, and appropriately analyze opportunistic sightings from fishing vessels, whale-watching vessels, charter vessels, etc.

1.1.10 Collect standardized data during aerial surveys on “close calls” between ships and whales.

1.1.11 Assess the utility and feasibility of ship routing changes in right whale habitat.

1.1.12 Assess the possibility of speed restrictions in right whale habitat.



1.1.13 Using existing data on whale sightings and vessel locations, conduct risk assessment analyses of various ship routing or speed options to assess the best set of vessel traffic management options by area.

1.1.14 Assess the potential economic impact of vessel management options.

1.1.15 Work with mariners, the shipping industry, and appropriate State and Federal agencies to develop and implement a regionally-based set of measures to reduce the threat of ship strikes.

1.1.16 Assess the effectiveness of ship strike measures and adjust, as necessary.

#### *Education and Outreach*

1.1.17 Establish regionally-based liaison positions to work directly, and maintain a dialog, with the shipping industry, discuss feasibility of various management measures, foster industry cooperation, and conduct related activities.

1.1.18 Develop programs and materials to educate mariners about right whales, to provide recommended practices for avoiding ship strikes, and to educate the shipping industry about steps being taken to reduce ship strikes. Make provisions for ongoing distribution of materials.

1.1.19 Routinely review and update information about right whale habitat and high-use areas, right whale vulnerability to ship strikes, and related ship collision reduction measures on nautical charts, *Coast Pilots*, published *Notice to Mariners*, and other appropriate navigational aids.

#### *Mandatory Ship Reporting Systems*

1.1.20 Continue to implement mandatory ship reporting systems along the east coast of the United States.

1.1.21 To the extent possible, use incoming information from the reporting system for analysis of ship volume and routing studies with a view to assessing possible measures to reduce ship/whale interactions.

1.1.22 Periodically assess the effectiveness of existing ship reporting systems and reporting areas -- both with regard to their operation and capacity to reduce ship strikes -- and consider implementing others or expanding the existing ones, as necessary.

1.1.23 Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.

1.1.24 Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.

#### *Whale Detection Technology*

1.1.25 Conduct studies of active acoustic (e.g., SONAR) and passive acoustic devices (e.g., “pop-up buoys”), and other underwater acoustic technologies on southern right whales to determine their feasibility and efficiency in detecting submerged whales.

1.1.26 If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, implement systems to use the devices to reduce ship/whale interactions.

1.1.27 Assess the utility and effects of such devices on relatively large scales: high whale-use areas and times, or high ship-use areas and times, or perhaps on regional scales.

1.1.28 Conduct studies of whale behavior relative to various types of “alerting” sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships, and assess the desirability of deploying such devices in an environment already heavily polluted by noise.

1.1.29 Assess the feasibility of improved visual detection technologies.

1.1.30 Assess the feasibility and utility of remote sensing to characterize right whale distribution patterns and to develop predictive models of right whale distribution patterns near high ship-traffic areas.

#### *Geographic Information Systems (GIS)*

1.1.31 Incorporate data from “whale alert” aircraft surveys, scientific survey data, other confirmed right whale sightings and ship traffic data obtained from the mandatory ship reporting system, in GIS for analysis of whale/ship interactions.

1.1.32 Establish or use existing GIS to (a) conduct analysis of environmental correlates for right whale occurrence and distribution, (b) prepare predictive models of where and when right whales are likely to occur, (c) determine times and areas in which right whales and heavy ship traffic are likely to occur, (d) analyze patterns of strandings, documented whale/vessel interactions, and “near-miss incidents”; and (e) assess ways to minimize ship/whale interactions.

1.1.33 Identify and obtain data from additional sources (e.g., biological and physical oceanographic data, human activities) for GIS application and analysis.

#### *Studies of the Effects of Ship Noise on Whale Behavior*

1.1.34 Using benign techniques, conduct studies of whale responses to ship noise and to ships of various types and speeds.

#### *Monitoring*

1.1.35 Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.

## 1.2 Reduce injury and mortality caused by fisheries and fishing equipment.

### *Operations*

1.2.1 Develop and implement strategies to modify fishing operations and gear in order to reduce the likelihood of entanglement, mitigate the effects of entanglements, enhance the possibility of disentanglement, and assess the effectiveness of such strategies.

1.2.2 Conduct research on alternative fishing methods. Implement methods that offer entanglement risk reduction.

1.2.3 Work with Canadian officials to develop means to reduce entanglement levels in Canadian waters.

### *Gear*

1.2.4 Conduct studies of gear modifications that reduce the likelihood of entanglement, mitigate the effects of entanglements, and enhance the possibility of disentanglement.

1.2.5 Design and implement programs to incorporate above gear modifications into the fisheries operations.

1.2.6 Develop and implement schemes to reduce the rate at which gear is lost, and improve the reporting of lost gear.

### *Reporting*

1.2.7 Continue to prepare and distribute information on whale entanglement to fishermen and other mariners, encourage reporting of entanglements to the disentanglement network, and periodically assess the effectiveness of such programs.

1.2.8 Continue, expand, and improve procedures for responding to reports of entangled whales.

1.2.9 Expand fisheries observer programs.

1.2.10 Continue to review, evaluate, and act upon reports from fishermen and fishery observers of fishery interactions with right whales.

1.2.11 If evaluations indicate that reporting can be improved, implement improved systems for such reporting.

### *Disentanglement*

1.2.12 When possible and practicable in terms of safety, disentangle whales caught in fishing gear.

1.2.13 Create and maintain regional disentanglement equipment caches and make appropriate arrangements to get disentanglement response teams and equipment to entangled whales.

1.2.14 Develop and train additional disentanglement response teams.

1.2.15 Design and conduct studies on advanced disentanglement gear.

1.2.16 Identify and implement ways to improve disentanglement efforts.

*Monitoring of Entanglement Rates and Evaluation of Protective Measures*

1.2.17 Monitor entanglement-related injury and mortality rates.

1.2.18 Determine whether measures to reduce entanglement are effective.

1.2.19 Identify and implement steps to improve protective measures.

*Photo-identification Data Analysis*

1.2.20 Review and evaluate stranding data and photo-identification data to monitor rates and effects of interactions with fishing gear, and assess effectiveness of mitigation measures.

1.3 Continue and Improve Education and Outreach Programs

*Providing Relevant and Timely Information*

1.3.1 Continue and expand efforts to inform mariners and the shipping industry, and fishermen and the fishing industry, about right whale vulnerability to ship strikes and fishing gear entanglement.

1.3.2 Ensure that right whale protective measures are incorporated into maritime policy guidance documents of the International Safety Management Code and curricula of the USCG and maritime academies.

1.3.3 Raise awareness of right whale conservation via voyage planning and merchant mariner qualification and licensing programs (in the U.S., British Admiralty, and industry).

1.4 Enforcement of fishing and shipping regulations.

1.4.1 Continue and improve programs to ensure that fishing and shipping regulations are enforced.

1.4.2 Review and assess the implementation and efficacy of the enforcement programs, and take steps to improve the enforcement measures if deficiencies are identified.

2.0 Develop demographically-based recovery criteria.

3.0 Identify, characterize, protect, and monitor important right whale habitats.

3.1 Characterize and Monitor Right Whale Habitat

3.1.1 Compile or collect relevant physical, chemical, biological, meteorological, fishery, and other data to characterize features of important

habitats and potential sources of human-caused destruction and degradation of critical habitats.

3.1.2 Monitor human activities to assess potential right whale habitat degradation.

3.1.3 Monitor essential habitat features to assess potentially detrimental shifts in these features.

3.1.4 Develop, implement, and monitor habitat protection strategies.

3.1.5 Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.

3.1.6 Conduct comparative studies to more accurately characterize critical habitats, using known shifts in habitat use as opportunities to test distribution hypotheses.

3.1.7 Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.

3.1.8 Support Canadian right whale conservation areas.

3.1.9 Support efforts to collect and compile data on habitat use patterns (breeding, foraging, and migratory areas) for the eastern North Atlantic right whale population.

3.1.10 Collaborate with international authorities to protect important habitats (when and if identified) for the eastern North Atlantic right whale population.

### 3.2 Assess modifying critical habitat boundaries.

3.2.1 Analyze available data and collect additional whale sighting data as necessary to assess expanding or modifying the critical habitat boundaries.

3.2.2 If warranted, revise critical habitat boundaries.

### 3.3 Reduce Human Impact to Habitat

#### *Coastal Development*

3.3.1 Conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution, behavior, and productivity of right whales.

3.3.2 As feasible, take steps to minimize identified adverse effects from coastal development.

#### *Anthropogenic Noise*

3.3.3 Conduct studies to assess the direct and indirect effects of anthropogenic noise on the distribution, behavior, and productivity of right whales.

3.3.4 Take steps to minimize identified adverse effects to right whales from anthropogenic noise.

*Pollutants*

3.3.5 Conduct studies to assess the sources and levels of anthropogenic pollutants and assess their possible adverse effects on right whales and their habitats.

3.3.6. Take steps to minimize identified adverse effects from anthropogenic pollutants.

3.3.7 Conduct studies of individual health and body condition as they may be related to accumulated contaminants.

*Oil and Gas Exploration and Development and other Industrial Activities*

3.3.8 Conduct studies to assess possible adverse effects of oil, gas, and hard mineral exploration and development and other industrial activities.

3.3.9 Take steps to minimize identified adverse effects from oil, gas, and hard mineral exploration and development.

3.3.10 Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.

3.3.11 Assess and update, as necessary, existing contingency plans for oil and chemical spills in waters where right whales occur. Local, regional, and national authorities should all participate in the development of integrated plans.

*Whale-Watching*

3.3.12 Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels.

3.3.13 Assess the effectiveness of existing restrictions on whale watching activities to determine whether more restrictive measures are necessary or less restrictive measures could be permitted.

3.3.14 Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.

3.4 Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales.

3.4.1 Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.

3.4.2 Review and refine energetic models to better understand right whale food requirements and feeding strategies.

4. Monitor the status and trends of abundance and distribution of the western North Atlantic right whale.

*Status*

4.1 Develop quantitative recovery criteria population models to determine extinction risk, and parameters to validate the model predictions.

4.2 Conduct a study or convene a workshop to determine the best methods for assessing western North Atlantic right whale status and trends, and to establish the optimal level of effort required.

4.3 Assess population size, survival rate and trends on a regular basis.

4.3.1 At least once every three years, review and evaluate data on western North Atlantic right whale status. Continue to review stock assessment at least annually in accordance with the MMPA. If needed, improve data collection and analysis methods.

4.3.2 As necessary, develop and implement other programs necessary for population monitoring.

*Distribution*

4.4 Monitor right whale occurrence and habitat use pattern in known high-use areas.

4.4.1 Continue to conduct annual winter surveys for right whales off the southeastern U.S. coast.

4.4.2. Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.

4.4.3. Continue annual spring surveys for right whales in the Great South Channel.

4.4.4 Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.

4.4.5 Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.

4.4.6 As often as possible and where feasible, photo-identification photographs should be obtained at each sighting.

4.4.7 Conduct studies to locate unknown high-use areas for the western North Atlantic right whale population.

4.4.8 Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, review of historical data, and results of predictive models.

4.4.9 Conduct surveys and/or support efforts to determine eastern North Atlantic right whale occurrence in coastal waters off Europe and northwestern Africa.

4.4.10 Continue to maintain a database of right whale sightings.

#### 4.5 Maintain a Photo-identification Database

4.5.1 Maintain and routinely update the right whale photo-identification catalog.

4.5.2 Require, as a condition of permits provided under the ESA or MMPA, that researchers conducting field work on right whales provide at the earliest convenience photographs (and ancillary information) obtained from their studies to the curators of the photo-identification catalog.

4.5.3 Regularly and consistently review, evaluate, and update analyses of data in the right whale photo-identification catalog.

4.5.4 Conduct studies to determine population structure using photo-identification data.

#### 4.6 Respond to Strandings

4.6.1 Continue and improve program for necropsy of right whale carcasses.

4.6.2 Review and, if needed, improve procedures for responding to reports of dead right whales and conducting necropsies to ensure that the most effective means are being used to extract scientific information from dead, stranded, and entangled right whales.

4.6.3 Improve or, as necessary, develop and implement protocols for securing and retrieving stranded or floating right whale carcasses.

4.6.4 To the extent possible, use necropsies to determine the cause of death and use such data to reduce the susceptibility to death from these causes.

4.6.5 Analyze tissue collected from stranded right whales to determine and monitor contaminant levels.

4.6.6 Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales.

4.6.7 Review, analyze, and summarize data on stranded right whales on a regular (at least annual) basis.

4.6.8 Develop and implement a program for handling live-stranded right whales.

4.6.9 Develop protocols for handling live-stranded right whales, including identification and securing of appropriate sites to effect rehabilitation.



4.6.10 Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.

#### 4.7 Conduct Habitat Use Studies (using telemetry)

4.7.1 Where feasible, effective, and minimally intrusive, conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and behavior.

4.7.2 Conduct studies to assess the most effective and least intrusive means of tagging right whales, including the possibility of using other species as models.

4.7.3. Conduct studies by veterinary experts to assess short- and long-term physiological impacts of tagging.

4.7.4 Continue and expand satellite-linked radio-tagging and tracking to identify right whale movements and habitat use patterns more effectively.

4.7.5 Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats.

4.7.6 When satellite tags are transmitting, conduct monitoring surveys to check for other right whales in the area of the tagged whale.

4.7.7 Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas.

#### 4.8 Assess Demography and Stock Structure

4.8.1 Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success.

4.8.2 Conduct genetics workshop.

4.8.3 Conduct studies of population demographics, including but not limited to such features as calf production, survivability, and age structure.

#### 4.9 Reproduction and Health Assessment

4.9.1 Conduct studies to determine the cause(s) of anomalous or fluctuating reproductive rates.

4.9.2 If cause(s) of reproductive anomalies are linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

4.9.3 Conduct studies to assess health at the individual and population level.

4.9.4 If studies indicate that poor individual or population health is linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

5. Coordinate Federal, State, international, and private efforts to implement the Recovery Plan.

5.1 Continue international ban on hunting and other directed takes of right whales.

5.2 Enforce right whale protection laws.

5.3 Evaluate the effectiveness of the Northeast and Southeast Implementation Teams and implement improvements as warranted.

5.4 Coordinate with States involved in right whale activities to maximize protection measures.

5.5 Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales, reduce human-related mortality and injury, report mortality events, promote protection of habitat, and take other measures to enhance the recovery of right whales.

5.5.1 Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures.

5.5.2 Promote actions to enhance protection for known areas of importance, especially vessel and fishery interaction issues in Canadian waters.

5.6 Periodically review and update the North Atlantic Right Whale Recovery Plan.

5.7 Prepare delisting monitoring plan for species before delisting occurs.

## B. Recovery Narrative

### 1. Minimize sources of human-caused death, injury, and disturbance.

#### Ship Strikes

Collisions with ships are a known major source of serious injury and death in western North Atlantic right whales. A total of 20 known right whale deaths are attributable to ship strikes in the last 30 years, and about 7% of all living North Atlantic right whales bear scars of interactions with ships.

<u>5-year period</u>	<u>known ship strike deaths</u>
1972-1976	3
1977-1981	1
1982-1986	3
1987-1991	2
1992-1996	6
1997-2002	5

The actual number is likely higher since not all strikes or ship struck carcasses are detected or reported. Reducing the frequency of these events is a major focus of this plan.

#### 1.1 Reduce ship collisions with right whales.

##### 1.1.1 Develop and implement a ship strike reduction strategy.

An overall strategy for reducing ship strikes must be developed. Such a strategy should include, but not be limited to, outreach and education programs for mariners, and means to implement ship strike reduction measures for all vessel classes. It will, at a minimum, incorporate the actions identified in this plan, and it should be a dynamic strategy that reflects the emergence of new information, any significant and unforeseen increase in ship strikes, and monitoring programs that assess the effectiveness of protective actions taken.

##### *“Sighting Advisory System”*

##### 1.1.2 Continue and improve seasonal aircraft surveillance of right whale habitats and other elements of the "sighting advisory system" program.

The whale alert program or so called "Sighting Advisory System" (SAS) (also referred to as Early Warning System) is a network of aircraft surveys to detect the locations of right whales, but is far from perfect in detecting right whales. Even in good weather and daylight, only an estimated 25-30% of the whales in a given area are actually detected by the surveys. In addition, the surveys are expensive to conduct. Nonetheless, they have been demonstrated to prevent collisions, at least to some degree, and they also lay important groundwork in mariner awareness of the issue. Programs such as these that raise industry awareness are necessary steps to implementation and acceptance of potential future protective measures. The program also provides sighting locations for other studies of right whale occurrence, distribution, relative abundance, and shifts in distribution. In addition, these surveys provide

important data relative to calving. Consequently, some level of SAS survey effort should be continued until viable alternatives are found.

#### 1.1.3 Provide right whale sighting locations to mariners through broadcasts and other appropriate media.

The system now provides whale sighting location information to mariners through USCG Broadcast Notice to Mariners (VHF and single side-band), NAVTEX (telex updates), and NOAA Weather Radio (VHF). This practice should be continued. The program should be evaluated to determine if other, more effective media would also be appropriate for relaying sighting location information. If additional media are identified, they should be used.

#### 1.1.4 When possible, notify individual ships directly when their course is likely to bring them to or near a location where a whale was sighted by the aircraft.

On a number of occasions, aircraft survey crews have notified ships that are on a course to intersect a whale's location and have suggested course alterations for the ship. This practice should continue. Because of difficulties in communicating with some foreign captains in the past, an effort should be made to address this problem through outreach programs and other means of reaching the non-English speaking maritime community.

#### 1.1.5 Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes.

The sighting advisory system provides sighting data for subsequent analysis of right whale occurrence and is believed to be the best existing system for notifying mariners about the risk of ship strikes. However, the effectiveness of the program in achieving this latter goal must be assessed in the near future. Specifically, such a review should address three major questions: (i) Do mariners receive the broadcast information and is it received in a timely fashion? (ii) Do they act upon it in some manner (i.e., does it cause them to take action that they would not have taken in the absence of the information)? and (iii) How effective are these mariner actions in preventing collisions with right whales? Data on "close calls" between ships and whales should be incorporated in the review. If such a review finds value to the program, it should be continued. However, the structure and methods of the program should be reviewed periodically to ensure that it is as effective as possible. Periodic reviews should include, but not be limited to, an evaluation of the location of survey lines, and an assessment of the most effective ways to provide timely and accurate reporting to mariners of the sighting information.

Because the program is expensive and relatively inefficient in locating whales, alternatives to the program should be sought. If viable and effective programs are found, the "sighting advisory system" should be replaced.

#### 1.1.6 While continuing to conduct surveys, standardize surveys and data collection to ensure data obtained from the surveys are of maximum use for subsequent analysis of whale distribution and abundance.

In conjunction with periodic reviews of the sighting advisory system, the survey program should be evaluated to ensure that data collection is standardized, including standardization between years, and between surveys (spatially and temporally) such that the data obtained are of maximum use to subsequent analysis of right whale distribution and population assessment. A standardization will facilitate data analysis, however, any such effort must always focus on the primary purpose of the surveys: the reduction of ship strikes.

1.1.7 Establish a program for regular and timely analysis of aircraft survey data to determine seasonal whale distribution and abundance and to contribute to predictive modeling exercises of environmental correlates relative to whale distribution, whale distribution relative to ship traffic, and use in subsequent risk analysis.

As survey methods and routes are standardized, the data derived should be used in analysis of right whale distribution and abundance. Also, as indicated elsewhere in this outline, these data also represent useful contributions to studies of oceanographic and environmental features that influence right whale distribution and identification of ways to reduce the occurrence of ship strikes. The data should also be made available to those maintaining right whale-related GIS; and the transfer of these data for analysis should be made immediately after the conclusion of the field season, or as soon thereafter as possible.

#### *Vessel Traffic Management*

It is clear that every feasible action should be taken to reduce the likelihood of ship strikes. Coordinated effort is needed to explore all possibilities of reducing the risk. Some actions, such as requiring reductions in ship speed in certain areas or modifying ship routing patterns, may cause economic hardship. While such measures may be burdensome or contentious, they will be necessary to consider because ship strikes continue to occur.

1.1.8 Use acoustic detection technology (e.g., “pop-up” buoys), surveys, and other technologies as available to monitor right whale occurrence and distribution in waters off the mid-Atlantic states.

Waters off the mid-Atlantic states are likely important migration corridors for right whales moving from feeding and nursery areas. Likewise, these are areas in which human impact also occurs, ship strikes in particular. Surveys, using aircraft/visual and/or acoustic technologies, should be done to assess the relative importance of this area for right whales and whale distribution within the area.

If human impacts are occurring – as it currently appears they are – then steps should be taken to establish protective measures in waters off the mid-Atlantic states.

1.1.9 Develop a system to encourage, collect, and appropriately analyze opportunistic sightings from fishing vessels, whale-watching vessels, charter vessels, etc.

Right whale sightings from opportunistic sources would complement data collected through standardized ship and aerial surveys, and add valuable information to the existing body of knowledge on distribution and abundance. A system to collect, compile, and analyze these reports should be developed and implemented throughout right whale habitat usage areas.

1.1.10 Collect standardized data during aerial surveys on “close calls” between ships and whales.

Little information currently exists to provide detail on specific interactions between ships and whales. By collecting data on “close calls,” potential ship strike incidents can be analyzed to better understand how, when, and where ship strikes to right whales are most likely to occur. Such a database will provide insight into both whale and mariner behavior during a potential ship strike event, and thus inform management efforts to reduce or eliminate this severe threat to the species.

1.1.11 Assess the utility and feasibility of ship routing changes in right whale habitat.

Studies are needed of the advantages and disadvantages of mandatory routing changes to reduce the threat of ship strikes. NMFS is currently evaluating various regulatory options. A workshop on management options was held in April 2001 and recommendations for ship strike reduction management options were provided by the Northeast and Southeast teams for implementation of the right whale recovery plan based on a contracted study. Risk assessment analyses are underway.

Whereas a variety of shipping industry management options in all areas should be assessed, ship activities in the Southeast U.S. (SEUS) critical habitat warrant particular consideration given the high level of traffic and the aggregation of mothers and calves that occur there. Hundreds of ship passages occur annually through SEUS right whale critical habitat in the entering ports of Jacksonville, Kings Bay, Mayport, Brunswick, Cape Canaveral, and Fernandina. One measure under consideration is to minimize the transit time and distance through the habitat by requiring ships to approach and depart the coast on east-west headings through critical habitat, rather than at more oblique angles. Studies should be conducted to determine whether such a modification of ship traffic patterns into all major SEUS ports is likely to decrease the probability of ship strikes. At the time of this writing, these assessments are underway.

All U.S. Navy ships transiting between port and offshore waters currently are directed to use such courses, and the Navy is to be commended for those efforts. If such changes in routing are made for commercial ships, an added advantage is the need to only closely survey and monitor smaller and more finite areas than being surveyed under the existing sighting advisory system.

Specific routing measures should be required in all areas along the eastern seaboard where such measures are determined to provide ship strike reduction.

1.1.12 Assess the possibility of speed restrictions in right whale habitat.

Ships moving at slow speeds may reduce the likelihood of right whale ship strikes, and risk reduction assessment studies of such measures are needed. As noted above, these studies are underway. Also, reduced ship speed measures may be used in conjunction with ship routing measures.

1.1.13 Using existing data on whale sightings and vessel locations, conduct risk assessment analyses of various ship routing or speed options to assess the best set of vessel traffic management options by area.

Risk assessment analysis – involving whale sighting locations to ship traffic patterns – can be an important tool in assessing the set of ship management options to reduce ship strikes. Such analyses should be specific to each region.

1.1.14 Assess the potential economic impact of vessel management options.

As noted above, it is possible that some adjustments to ship operations will result in relatively minor economic impacts; and studies are needed to determine economic burden of certain options. If economic burdens are small, the shipping industry may be amenable and open to making relatively simple modifications to ship operations which reduce the risk of ship strikes.

1.1.15 Work with mariners, the shipping industry, and appropriate State and Federal agencies to develop and implement a regionally-based set of measures to reduce the threat of ship strikes.

Given the expertise it offers, the shipping industry should be involved in developing and implementing ship strike reduction protection measures.

1.1.16 Assess effectiveness of ship strike measures and adjust, as necessary.

Programs should be established to monitor the effectiveness of steps taken to reduce ship strikes. If ship strikes continue at the same or an increased rate, increasingly stringent measures should be implemented.

#### *Education and Outreach*

Each ship traversing or planning to traverse areas where right whales occur should be provided with as much information as possible on the vulnerability of right whales to ship strikes and precautions about avoiding right whales. Therefore, programs should be developed, or maintained and improved if they exist, to improve mariner awareness about this problem. Liaison and dialog with the shipping industry should be established to ensure the industry is aware of protective measures and to explore ways to further reduce the risk of ship strikes. In addition, navigational aids should include such information. Ships' captains in U.S. waters are required to carry and consult U.S. *Coast Pilots* and all mariners consult NOAA marine charts. These aids to the mariner should contain accurate and current information on the occurrence of right whales, the 500-yard no approach rule, critical habitat, precautionary measures on avoiding ship strikes, and other relevant information.

1.1.17 Establish regionally-based liaison positions to work directly, and maintain a dialog, with the shipping industry, discuss feasibility of various

management measures, foster industry cooperation, and conduct related activities.

Communication between appropriate entities is a key element to addressing the problem of ship strikes. Positions should be established and filled with people with knowledge of, and contacts within, the industry to serve as liaison and be a conduit of information to and from the industry and management agencies. Further, this role will be critical to working with representatives of the industry and management agencies to assess the effectiveness of existing programs and explore new protective measures.

1.1.18 Develop programs and materials to educate mariners about right whales, to provide recommended practices for avoiding ship strikes, and to educate the shipping industry about steps being taken to reduce ship strikes. Make provisions for ongoing distribution of materials.

Providing current, readily understood, and high-quality information to mariners about ship strikes is critical. Some materials are already provided. Efforts should be made to ensure these are current and to have programs in place for their distribution.

1.1.19 Routinely review and update information about right whale habitat and high-use areas, right whale vulnerability to ship strikes, and related ship collision reduction measures on nautical charts, *Coast Pilots*, published *Notice to Mariners*, and other appropriate navigational aids.

Recent efforts have ensured that *Coast Pilots*, nautical charts, Notices to Mariners, and Sailing Directions contain information on critical habitat and the 500-yard no approach rule, and related information on right whale occurrence and precautionary measures that can be taken to avoid striking right whales. These documents should be reviewed annually to ensure that the information is accurate and current. If possible, other similar documents should be identified and similarly updated annually.

#### *Mandatory Ship Reporting Systems*

1.1.20 Continue to implement mandatory ship reporting systems along the east coast of the United States.

A Mandatory Ship Reporting (MSR) system proposed by NOAA and the USCG was adopted by the International Maritime Organization (IMO) in December 1998. It became operational in July 1999. The systems operate in two areas: the Great South Channel and Cape Cod Bay off Massachusetts year round, and in the major calving ground off the Georgia/Florida coast (November – March). They require all commercial ships over 300 tons to report to a shore station when entering right whale habitat. In return, ships receive an automated message about right whales, precautionary measures for avoiding ship strikes, and locations of right whale sightings. The system is also expected to provide information about the movements of ships through right whale critical habitats; these data are essential to the planning of future mitigation measures.



1.1.21 To the extent possible, use incoming information from the reporting system for analysis of ship volume and routing studies with a view to assessing possible measures to reduce ship/whale interactions.

Incoming data from ships passing through right whale critical habitat should be assessed relative to right whale occurrence in the particular habitat, in order to aid in identifying additional steps that can be taken to reduce ship strikes.

1.1.22 Periodically assess the effectiveness of existing ship reporting systems and reporting areas -- both with regard to their operation and capacity to reduce ship strikes -- and consider implementing others or expanding the existing ones, as necessary.

While it is generally believed that the reporting systems help reduce the risk of ship strikes, the effectiveness of the systems in doing so needs to be assessed at least once every two years. In addition, assessments should be done to determine ways to improve the systems. For example, if effective in reducing the likelihood of ship strikes, consideration should be given to expanding the reporting areas or perhaps creating new reporting areas elsewhere.

1.1.23 Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.

Early indications are that not all ships entering right whale critical habitat have reported to the systems, although doing so is mandatory under U.S. law. Lower than expected compliance rates are almost certainly linked to the fact the program is relatively new. Compliance rates will likely improve, but mariners may also not be aware of the program, do not understand its significance, or do not know how to report. It is possible that ships entering U.S. ports for the first time or ships that do not frequent U.S. ports near right whale critical habitat (e.g., foreign flag ships) are not aware of the reporting systems. Regardless, steps should be taken to improve compliance by improving the outreach program and by considering issuing fines for ships that do not report. In spring 2001, the USCG began issuing letters to non-reporting ships explaining that fines may be levied for ships that do not report.

1.1.24 Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.

A number of steps have been taken to “advertise” and explain the use of the system. For example, educational placards and other materials have been developed and are routinely distributed by the USCG, and are made available at numerous shipping related venues. A web site has been created. In addition, ships that do not report are contacted by the USCG to explain MSR requirements and provide information on how and when to report. Nonetheless, relatively low compliance rates suggest more needs to be done.

#### *Whale Detection Technology*

Existing or not-yet-developed technologies may be useful in reducing ship strikes by locating whales and using the information to alert mariners to whale locations. Promising technologies should be identified and experiments should be conducted to determine their effectiveness. If deemed effective in

field trials, and if the technologies meet legal requirements (e.g. do not adversely affect endangered or threatened species, can be permitted for use), such technologies should be put into use as soon as possible. At the time of this writing, the most promising technologies are active acoustic (e.g., SONAR) devices, and passive listening systems to detect whales. More work is needed to explore the use of enhanced visual detection. Remote sensing systems may be useful in locating whales at the surface and “alerting” devices affixed to ships should be considered.

1.1.25 Conduct studies of active acoustic (e.g., SONAR) and passive acoustic devices (e.g., “pop-up buoys”), and other underwater acoustic technologies on southern right whales to determine their feasibility and efficiency in detecting submerged whales.

Existing SONAR devices, or ones under development, might be capable of detecting submerged whales. They may be particularly useful in areas where ship traffic routes are finite and clearly delineated to relatively small areas, such as shipping channels off the southeast United States. Severe limitations include cost and the capacity to differentiate whales from other biological features (e.g., fish schools) or oceanographic features (e.g., certain types of water masses). However, use of such devices should be done carefully given possible adverse effects to other marine taxa and of increasing exposure of whales to noise. Therefore, studies should be conducted to assess the impact on marine mammals of acoustic pollution from proliferation of SONAR devices, and determine whether potential cost exceeds potential benefit to right whales. If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, and are shown to be environmentally benign, steps should be taken to use the devices to reduce ship/whale interactions. Tests of such technologies might best be carried out on southern right whales so that no unintended and unforeseen harm is caused to North Atlantic right whales during this developmental phase.

It should also be clarified that “pop-ups” (archival recording units) are useful for recording the presence or absence of right whales, but not in “real time.” Therefore, they are unlikely to be useful in monitoring programs intended to separate whales and ships in “real time”.

Large-scale passive listening systems, such as the Navy's "Sound Surveillance System" (SOSUS) hydrophone arrays, have been used successfully to detect and track several large whale species over great distances by localizing their vocalizations. Smaller scale arrays may be useful in localizing right whales. “Pop-up buoys”, now being studied for detecting whales, and other passive listening systems may have promise. However, there are limitations. For example, preliminary indications are that right whales do not vocalize frequently in some settings and while engaged in some behavior. An assessment of any such system should be mindful that “real-time” capabilities to relay sighting information to mariners is essential. Also, right whales are distributed largely over the continental shelf where systems such as the SOSUS array are ineffective (for reasons related to bathymetry) in detecting right whales.

1.1.26 If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, implement systems to use the devices to reduce ship/whale interactions.

As indicated above, if such devices are successful at detecting whales, meet legal requirements, and potential benefit exceeds potential cost, they should be deployed as soon as possible. Information on detected whales should be promptly transmitted to transiting ships using existing procedures. However, they should be chosen and used judiciously as their use may have adverse effects on other species.

1.1.27 Assess the utility and effects of such devices on relatively large scales: high whale-use areas and times, or high ship-use areas and times, or perhaps on regional scales.

If underwater acoustic devices effectively detect submerged whales with some relatively high level of probability, they should be assessed for wide-scale use to reduce the risk of ship strikes. It may be possible to deploy passive listening systems on fairly wide scales such as primary shipping lanes, or whale aggregation areas. It may be possible to deploy them seasonally in certain areas.

The use of SONAR devices, however, is likely to be problematic as (a) there may be potential for adverse effects to other taxa, (b) they increase the level of noise in the ocean, whereas a reduction is preferable, (c) the sound source may need to be substantial to increase the range of detection, and (d) deploying devices on ships may be difficult and expensive. Studies should be conducted to assess the impact on marine mammals of acoustic pollution from proliferation of such SONAR devices, and determine whether potential cost exceeds potential benefit to right whales.

1.1.28 Conduct studies of whale behavior relative to various types of “alerting” sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships, and assess the desirability of deploying such devices in an environment already heavily polluted by noise.

Three factors that likely contribute to the occurrence of ship strikes are that right whales (a) spend considerable time at the surface, (b) apparently spend relatively long periods of lowered sensory awareness while “rafting” at the surface, and (c) apparently can be so focused on vital activities (e.g., feeding, nursing, or courtship) that they do not notice or react to an oncoming ship. It may be possible to alert or warn the animals that a ship is approaching by activating an alarm or acoustically offensive or painful warning device on the vessel. However, use of such devices should be done with extreme caution. The underwater world is already a very noisy place for animals that rely on sound for vital functions and the introduction of more noise should be considered very carefully. In addition, the idea of repeatedly deterring whales from a preferred habitat needs to be carefully considered. Also, equipping scores of ships with such devices would not only be costly and logistically complicated, but also might confuse or stress right whales. Therefore, carefully designed experiments should be carried out to assess right whale responses to such devices, possibly using a less endangered but related species as a model (e.g., the southern right whale).

#### 1.1.29 Assess the feasibility of improved visual detection technologies.

Enhanced visual detection of whales at the surface from ships may reduce the risk of ship strikes. If feasible, enhanced visual detection technologies may be a relatively economical way to improve detection, and may be particularly useful in low light or poor visibility situations. Some technologies, such as night vision scopes and infrared cameras, have been studied for some whale species, but their utility has not been fully explored. Studies should be done to determine if improved visual detection technologies are plausible and, if so, programs should be established to deploy such devices.

#### 1.1.30 Assess the feasibility and utility of remote sensing to characterize right whale distribution patterns and to develop predictive models of right whale distribution patterns near high ship-traffic areas.

A number of remote sensing technologies, such as various types of satellite-based imagery, may have the capability to detect right whales, and such technologies that might be promising in this regard should be evaluated. If these techniques are able to detect right whales remotely, it may be possible to collect considerable quantities of such data in relatively short amounts of time. If so, right whale location data should be used in developing predictive models of right whale occurrence and distribution relative to oceanographic features and relative to shipping lanes. Also, sighting locations could then be transmitted in real time to mariners as areas to be avoided.

### *Geographic Information Systems (GIS)*

#### 1.1.31 Incorporate data from “whale alert” aircraft surveys, scientific survey data, other confirmed right whale sightings and ship traffic data obtained from the mandatory ship reporting system, in GIS for analysis of whale/ship interactions.

A GIS is most powerful when appropriate questions are asked and tested, and when the best available information is used. Seasonal surveys (both for the whale alert program and scientific assessment purposes) generate considerable data on right whale locations and ship traffic distribution in certain areas. These data should be made available to GIS analysts as soon as possible and analyzed using GIS or other appropriate systems; analysts should be prepared to provide periodic results of analysis of whale distribution relative to ship distribution in a timely manner. Such analyses may in turn lead to protective measures for right whales relative to ship traffic. Several right whale databases currently exist, but it is not clear if the systems are compatible. Efforts should be made to create a centralized right whale GIS database, or at minimum, steps should be taken to ensure that independent databases (e.g., format, structure, software) are compatible to foster exchange of information and to facilitate collaborative analyses.

#### 1.1.32 Establish or use existing GIS to (a) conduct analysis of environmental correlates for right whale occurrence and distribution, (b) prepare predictive models of where and when right whales are likely to occur, (c) determine times and areas in which right whales and heavy ship traffic are likely to occur, (d) analyze patterns of strandings, documented whale/vessel

interactions, and “near-miss incidents”; and (e) assess ways to minimize ship/whale interactions (see 1.e, above).

When used to their full potential, GIS can be powerful tools for storing, displaying, and analyzing diverse data sets. In recent years, GIS have been used for sophisticated analysis in many disciplines. Establishing and maintaining a GIS, or a set of GIS, devoted wholly or largely to right whale and right whale related data would be useful in addressing specific biological questions and helping to identify protection measures. Individuals and entities with interest in creating such a system should be identified and efforts made to identify and secure databases relevant to right whale management.

Steps should be taken to ensure that appropriate data "coverages" are derived (or obtained) and verified. Among the most important of these are coverages of right whale sighting locations, both historic and recent. These data should be updated periodically – at least once every two years. Analysis of such data and trends in the data may provide information on local or large-scale shifts in right whale distribution. When combined with information on features that characterize right whale habitat, predictors about right whale habitat use and occurrence are likely to emerge. In addition, coverages of ship traffic patterns and distribution should be created and compared to whale sighting locations. When possible statistical analyses should be used; however, visual analysis alone may also reveal patterns worthy of further consideration.

1.1.33 Identify and obtain data from additional sources (e.g., biological and physical oceanographic data, human activities) for GIS application and analysis.

As noted above, the most current and complete data sets should be incorporated into GIS and GIS-related analyses. Therefore, relevant databases on physical and oceanographic data should be identified, and when possible, made available to GIS analysts. These should include, but may not be limited to, data on salinity; sea surface temperature; bathymetry indicators of basin-scale and smaller oceanic fronts; indicators of internal waves and other relatively localized fronts; chlorophyll or other indicators of primary productivity; right whale prey occurrence, abundance and density; and distribution of various marine vertebrate (e.g., sea birds) and invertebrate (e.g., copepods) species. In this regard, attempts should be made to link right whale distribution to environmental correlates.

#### *Studies of the Effects of Ship Noise on Whale Behavior*

1.1.34 Using benign techniques, conduct studies of whale responses to ship noise and to ships of various types and speeds.

A series of studies should be designed and conducted to examine whale response relative to approaching ships (e.g., Terhune and Verboom 1999). Similar studies should be conducted on whale response to ships of various sizes and while traveling at various speeds. Such studies should consider, but not be limited to, quantification of noise levels fore, aft, and abeam of vessels of various size, class, and hull-design, and at various depths. There may be "acoustic shadows" directly in front of a ship and other noise magnification or nulling nodes at various distances from ships or at various depths.

Assessments should be made about whether whales can detect ships and their interactions to the vessels. Modeling studies of ship hydrodynamics and ships transiting through right whale habitat (employing assumptions about whale behavior and ships size and speed) should also be considered.

### *Monitoring*

1.1.35 Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.

## 1.2 Reduce injury and mortality caused by fisheries and fishing equipment.

Entanglement in fishing gear is a known major source of injury and death in right whales. While entanglement is not always fatal, it can seriously disable a whale; and death can result from lengthy entanglements.

All reasonable efforts should be made to reduce the rate of entanglement and to free or facilitate the freeing of whales caught in fishing gear. Activities being undertaken by the NMFS, under the auspices of the Atlantic Large Whale Take Reduction Plan (e.g., time/area closures, gear modification research), should be continued and closely monitored to evaluate their effectiveness. Options considered should include, but not be limited to, time/area closures, alternative gear, and gear modifications. These measures should be altered if they are found to be ineffective in attaining their objectives.

As long as right whales continue to die or receive serious injury from entanglement in fishing gear (given that the Potential Biological Removal for this population under the MMPA is zero), increasingly stringent measures will be needed to eliminate such impacts. As noted above, gear modification research should continue and promising modifications should be used in fisheries. Moreover, consideration should be given, for example, to increasing the temporal and spatial scopes of time/area fishery closures, as well as other measures to reduce entanglement. It may become necessary to strongly curtail some fisheries in some areas.

### *Operations*

1.2.1 Develop and implement strategies to modify fishing operations and gear to reduce the likelihood of entanglement, mitigate the effect of entanglements and enhance the possibility of disentanglement, and assess the effectiveness of such strategies.

If entanglements continue or increase, increasingly stringent steps should be taken to reduce entanglement rates. Steps should be taken, for example, to assess and, if necessary, implement additional time/area fishery closures or universal gear restrictions.

1.2.2 Conduct research on alternative fishing methods. Implement methods that offer entanglement risk reduction.

The gear types most involved in the entanglement of right whales are lobster pots (and their accompanying lines), and set nets. Studies should be conducted on means to catch target species using alternative gear.

### 1.2.3 Work with Canadian officials to develop means to reduce entanglement levels in Canadian waters.

Some right whale entanglements occur in Canadian waters. Therefore, Canada and the United States should ensure that all reasonable actions are taken to minimize right whale entanglement and to ensure that protective measures complement each other. Bi-lateral meetings should be held periodically to assess the effectiveness of efforts to reduce entanglement and to exchange information on ways to improve protective measures.

#### *Gear*

### 1.2.4 Conduct studies of gear modifications that reduce the likelihood of entanglement, mitigate the effects of entanglements, and enhance the possibility of disentanglement.

Current and ongoing research on possible modifications to fishing gear that facilitate an entangled whale to free itself once entangled should be continued and accelerated. These studies might include, but should not be limited to, assessment of bio-degradable lines, ways to reduce the number and length of vertical lines, increasing the visibility of vertical lines, designing breakaway links for heavy gear, and acoustic deterrents. The most effective and promising modifications should be implemented as soon as possible. The degree to which modifications allow entangled whales to free themselves should be closely monitored. Modifications that seem promising should be the subject of further research and implemented if deemed effective.

### 1.2.5 Design and implement programs to incorporate gear modifications that reduce entanglement into the fisheries operations.

When modifications are found to be effective in reducing entanglement, they should be implemented into fishing operations immediately.

### 1.2.6 Develop and implement schemes to reduce the rate at which gear is lost, and improve the reporting of lost gear.

Some lost gear, e.g., from trawling in areas where gillnets and lobster pots are already set, may be avoidable. Strategies for doing so should be investigated and implemented, if feasible. Reporting of lost gear and perhaps marking of gear so that it can be “tracked” are additional approaches that should be considered.

#### *Reporting*

When an entanglement occurs or when an entangled whale is seen, it is vital that such information is relayed to the proper authorities in a timely manner. Therefore, programs directed at obtaining information about the location and circumstances of entangled whales should be continued and expanded. Maintaining contact with the entangled whale until help arrives can be key to a successful response, and therefore should be emphasized.

### 1.2.7 Continue to prepare and distribute information on whale entanglement to fishermen and other mariners and encourage reporting of entanglements to

the disentanglement network, and periodically assess the effectiveness of such programs.

Fishermen themselves are essential to the process of reducing entanglements and freeing entangled whales; and their continued involvement should be encouraged. In this regard, ongoing efforts to inform fishermen about disentanglement efforts and the need to report entangled whales should be continued. This information dissemination program should also be evaluated periodically to ensure that it is as effective as it can be in reaching all relevant fishermen and that information on entangled whales is being obtained as efficiently as possible. For example, it may become apparent that reports of entangled whales come from sources other than fishermen and, if so, efforts directed at encouraging reports by mariners other than fishermen may be more cost-effective.

#### 1.2.8 Continue, expand, and improve procedures for responding to reports of entangled whales.

Prompt response to reports of entangled whales is essential. Procedures need to be in place to ensure that response is swift. Efforts to increase the scope and improve the efficiency of the system should be ongoing.

#### 1.2.9 Expand fisheries observer programs.

Observer programs are a good source of information on entangled right whales, but they can be exceedingly costly. Where feasible, such programs should be expanded to include more fisheries and to provide increased coverage of fisheries that have observer programs. For some fisheries (e.g., pot and trap fisheries) it may be necessary to develop alternative means of observing. In addition, programs aimed at educating fishermen and observers about disentanglement efforts and needed follow-up actions should be expanded.

#### 1.2.10 Continue to review, evaluate, and act upon reports from fishermen and fishery observers of fishery interactions with right whales.

As noted above, observer programs and programs designed to encourage involvement of fishermen should be evaluated to improve their effectiveness. Such evaluation should be ongoing. If deficiencies are identified, they should be addressed immediately.

#### 1.2.11 If evaluations indicate that reporting/response can/should be improved, implement improved systems for reporting.

Ways to improve reporting and/or responding may be identified. If so, they should be implemented immediately.

### *Disentanglement*



As long as fisheries are allowed to continue and remain economically viable, some level of entanglement is likely to occur. That is, entanglement is nearly inevitable. Therefore, disentanglement readiness, contingencies, and programs are essential, and should always be a high priority, since prevention of even a single mortality may be significant to recovery.

1.2.12 When possible and practicable in terms of safety, disentangle whales caught in fishing gear.

Whenever feasible, and with maximum regard for human safety, efforts should be made to free every entangled whale. Therefore, clearly defined contingencies and strategies should always be in place.

1.2.13 Create and maintain regional disentanglement equipment caches and make appropriate arrangements to get disentangling teams and equipment to entangled whales.

An essential component of disentanglement plans is possession of and rapid access to the proper equipment. Therefore, additional key sites where such equipment caches are needed should be identified so that equipment used in disentanglement efforts can be prepared and stored in these additional locations and made readily accessible to respond to an entangled whale anywhere along the U.S. eastern seaboard. It is essential to ensure all elements of each cache are well maintained and replaced as needed and that any newly identified equipment which proves useful (e.g., newly developed tools or newly discovered uses for existing products) is added to each cache. Also, plans should be designed for getting qualified and well-equipped disentanglement teams to any entangled whale along the entire U.S. eastern seaboard.

1.2.14 Develop and train additional disentanglement response teams.

Disentangling whales can be dangerous. Experienced, well-trained teams should be the only responders. Responding teams should be well-versed and experienced in disentanglement procedures. To better respond to entanglements and remote locations, additional disentanglement teams and personnel should be trained. Having several teams trained and prepared to respond would allow multiple teams to respond, if entanglements occurred simultaneously or in separate locations, and perhaps allow for a more prompt response to remote locations. Efforts to expand disentanglement response to the entire U.S. east coast should be reviewed and upgraded if necessary to ensure coverage is adequate.

1.2.15 Design and conduct studies on advanced disentanglement gear.

Existing disentanglement gear typically is "low-tech." However, it is possible that some methods or gear not currently used in such events may be useful in freeing a whale. Studies of possible advances in gear used for disentanglement should be done. If promising new advances are identified,

they should be made available and used. They should be added to equipment caches.

#### 1.2.16 Identify and implement ways to improve disentanglement efforts.

In the course of conducting disentanglements, ways to improve the chances of freeing a whale may become clear. If so, such improvements should be used in future events. Also, the principals in the disentanglement effort should meet periodically (at least annually), and in particular after each event, to discuss ways of improving the procedures used. Discussions should be held regarding the possible development of new, or refinement of existing, equipment, and ways to reduce response times.

#### *Monitoring of Entanglement Rates and Evaluation of Protective Measures*

It is imperative that any programs used to reduce fishing gear entanglement be monitored to determine their relative success. If monitoring studies indicate that scarring rates are not decreasing or other factors indicate that entanglement rates are not decreasing, additional and increasingly stringent protective measures should be identified and implemented.

#### 1.2.17 Monitor entanglement-related injury and mortality rates.

Data on the number of observed or reported entangled whales should be routinely compiled and regularly (at least annually) analyzed to assess patterns or trends in entanglement rates and entanglement related mortality. In addition, to the extent practicable, studies should be done of the severity of each entanglement event.

#### 1.2.18 Determine whether measures to reduce entanglement are effective.

Steps should be taken to evaluate the effectiveness of measures to reduce the risk of entanglement. Clearly, deaths caused by entanglement are an indication that adequate protective measures are not being used. However, a large number of right whales carry scars from previous entanglement events. Therefore, scarring rates and trends in scarring rates – from photo-identification data -- are a means (albeit perhaps not particularly precise) of assessing the relative effectiveness of protective measures. These and other techniques should be used to routinely assess the effectiveness of measures used.

#### 1.2.19 Identify and implement steps to improve protective measures.

If entanglement rates are not decreasing in spite of protective actions taken, those actions should be re-assessed and revised to reduce entanglement rates. The goal is to reduce the rate to a number as low as possible; and if the rate is not dropping, the various approaches to reduce fishery interactions should be re-evaluated and subsequently changed to include new or modified protective measures.

### *Photo-identification Data Analysis*

1.2.20 Review and evaluate stranding data and photo-identification data to monitor rates and effects of interactions with fishing gear, and assess effectiveness of mitigation measures.

One way to monitor the success of protective measures is through analysis of the individual photo-identification database for trends in scarring rates or evidence of new scars. Photo-identification studies can also provide indices of the relative health of individual whales. Other sources of such information are dead and stranded whales, which should be examined for evidence of entanglement, as well as identified to individual where possible, to allow for comparison with animals in the scarification catalogue.

### 1.3 Continue and Improve Education and Outreach Programs

Educating ship operators, the fishing community and other mariners (including recreational users) about the occurrence and distribution of right whales, their vulnerability to ship strikes and entanglement, and the steps that mariners can take to avoid right whales may be one of the simplest and most cost-effective ways of reducing the likelihood of these threats. Therefore, programs should be developed which describe a comprehensive outreach and education program. These programs should identify and describe the types of material, information and medium to be used, the expected target and expected outcome, and the expected number of people reached. They should also involve follow-up to determine if the expected effectiveness is being attained. Programs should be evaluated and improved periodically.

#### *Providing Relevant and Timely Information*

1.3.1 Continue and expand efforts to inform mariners and the shipping industry, and fishermen and the fishing industry, about right whale vulnerability to ship strikes and fishing gear entanglement.

Use all reasonable avenues to inform mariners and fishermen about the occurrence of right whales and their vulnerability to ship strikes and fishing gear entanglement. Such efforts should include, but not be limited to, development and distribution of brochures, placards, fliers, videos, articles in industry journals, and through direct liaison with the industry.

1.3.2 Ensure that right whale protective measures are incorporated into maritime policy guidance documents of the International Safety Management Code and curricula of the USCG and maritime academies.

The USCG has an important role in helping to educate ship operators about the vulnerability of right whales to ship strikes, inasmuch as USCG personnel are in frequent contact with vessel operators. The USCG-implemented International Safety Management Code is a useful vehicle through which mariners can be educated about right whales. Implementation of the code involves regular portside boardings of selected ships, and the exchange of

vessel- and human-safety related issues. A large number of mariners can be reached by including information on guidelines for avoiding ship strikes in material that is distributed. In this regard, the information that is distributed, and materials used to train inspectors and auditors should be periodically updated and steps should be made to ensure that current and appropriate information is being distributed. This information should be updated at least once every two years, and the program for disseminating such information should be assessed and, if necessary, improved on the same schedule.

Education of mariners about right whale conservation issues should begin in school. The curricula at maritime academies, including NOAA, U.S. Naval, and USCG academies, and other marine related schools, should include information on the status of right whales, their vulnerability to ship strikes, and measures in place or being contemplated to protect the species.

1.3.3 Raise awareness of right whale conservation via voyage planning and merchant mariner qualification and licensing programs (in the U.S., British Admiralty, and industry).

Programs are needed for recreational vessels and vessels engaged in domestic commerce as these are not necessarily covered by the ISM Code.

#### 1.4 Enforcement of fishing and shipping regulations.

1.4.1 Continue and improve programs to ensure that fishing and shipping regulations are enforced.

A number of fishing and shipping regulations have been instituted in recent years and a number of additional regulations are being contemplated at the time of this writing. These include, but are not limited to, vessel approach regulations, fishing gear and time/area restrictions as implemented through the Atlantic Large Whale Take Reduction Plan, and the Mandatory Ship Reporting system.

1.4.2 Review and assess the implementation and efficacy of the enforcement programs, and take steps to improve the enforcement measures if deficiencies are identified.

Regulations are only effective if they are adhered to. Steps should be taken to periodically summarize and analyze available information on rates of compliance with regulations adopted to protect North Atlantic right whales. Rates of compliance with these regulations are not routinely quantified at present and, while compliance is believed to be good, it can likely be improved. Steps need to be taken, and resources provided, to ensure that these and future regulations are enforced.

#### 2.0 Develop demographically-based recovery criteria.

Guidelines for large whale recovery criteria were developed at a workshop convened by NMFS in February 2001 and are reflected in the criteria found in this plan. The first of these criteria reflects the probabilistic thresholds for risk of extinction arrived at in the workshop. Specifically, according to the workshop, a large cetacean species shall no longer be considered endangered when, given current and projected conditions, the probability of extinction is less than 1% in 100 years; and a large cetacean species shall no longer be considered threatened when, given current and projected conditions, the probability of becoming endangered is less than 10% in a period of time no shorter than 10 years and no longer than 25 years, with the period depending on the volatility of the dynamics of the population, the power of the monitoring to detect changes and the expected response time of the management agency (Angliss et al. 2001). However, in order to ensure that criteria meets the standards of “objective and measurable” as called for in the ESA, NMFS believes that it is incumbent upon us to translate this guidance into demographic criteria, such as population numbers, structure, and trends, that allow the public to recognize clearly if they have or have not been met. Having said that, NMFS also recognizes that this species is currently in dire straights as reflected in consistently low population numbers, and that whatever criteria are arrived at under this action are subject to change as more is known about the species and as the species’ status improves.

Analyses used to develop recovery criteria will be peer reviewed before accepted, will expressly indicate the assumptions, goals, uncertainties and approximations of the models used, and will include sensitivity analyses of parameters and assumptions. In addition to being useful in examining the population viability analysis, sensitivity analyses can be useful in management of the species, and subsequent revisions or updates of this recovery plan.

### 3.0 Identify, characterize, protect, and monitor important right whale habitats.

#### 3.1 Characterize and Monitor Right Whale Habitat

Reducing direct and indirect threats to right whale habitat is integral to recovery. Information is needed on environmental factors that influence right whale occurrence and distribution. In addition, adequate protective measures are needed to reduce or eliminate human-related impacts to right whale habitat.

##### 3.1.1 Compile or collect relevant physical, chemical, biological, meteorological, fishery, and other data to characterize features of important habitats and potential sources of human-caused destruction and degradation of critical habitats.

Features of right whale habitat and environmental correlates of right whale distribution should be identified. Therefore, studies should be done to identify physical and biological determinants of right whale occurrence. That is, baseline data are needed on important components of the habitats. These should include, but should not be limited to, studies of relevant physical, chemical, biological, meteorological, prey species, fishery, marine vertebrate, and other data to characterize essential features of right whale habitats. Such information might be obtained through compilation and analysis (especially GIS-based analysis) of existing databases and through directed field studies.

In addition, studies should be done of potential adverse effects of human activities on right whales.

#### 3.1.2 Monitor human activities to assess potential right whale habitat degradation.

A number of human activities may affect right whale recovery through direct or indirect adverse effects on right whale habitat. These include, but are not limited to, fishing, commercial shipping and other vessel traffic, oil exploration and development and other industrial activities, oil spills, release of organochlorines, heavy metals and other contaminants into the marine environment, municipal effluents, noise pollution, and dredging. Such activities may involve direct and indirect disturbance of key prey species, disturb right whale use of a particular habitat, or otherwise degrade the habitat. Therefore, studies are needed to assess the potential adverse effects of these activities on right whale habitat.

#### 3.1.3 Monitor essential habitat features to assess potentially detrimental shifts in these features.

After baseline data are obtained and analyzed, ongoing studies should be done to determine if shifts are occurring in critical habitat components. Again, if shifts are detected and they are linked to human activities, actions should be taken to modify the activity to reduce or eliminate the causative agent.

#### 3.1.4 Develop, implement, and monitor habitat protection strategies.

If studies reveal that important right whale habitats are affected by human activities, steps should be taken to mitigate the effects or reduce or eliminate the source of the impacts. In addition, monitoring studies should be done to assess the effectiveness of protective measures that are put into place.

#### 3.1.5 Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.

Right whale distribution and habitat use should be assessed periodically through surveys and, among other things, GIS analysis. Shifts in distribution or habitat use should be flagged as potentially resulting from anthropogenic sources of habitat degradation or disturbance. If studies reveal that changes to right whale habitat use are directly or indirectly linked to human activities, steps should be taken to limit or modify the activities.

#### 3.1.6 Conduct comparative studies to more accurately characterize critical habitats, using known shifts in habitat use as opportunities to test distribution hypotheses.

Hypotheses should be formulated and tested regarding right whale habitat use and shifts in habitat use. Such testing should involve studies comparing current habitat use to past use, thereby providing an assessment of human-related shifts in distribution or habitat use.

3.1.7 Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.

Right whale range is transboundary. Protective measures should dovetail with measures being taken by the government of Canada. To the extent possible, such measures should include, but not be limited to, efforts to mitigate or reduce adverse effects from fishing activities, commercial shipping and other boat transits, the release of contaminants into the marine environment, oil spills, oil and gas exploration and development and other industrial activities, and activities that introduce loud noises into the marine environment. Bi-lateral cooperation should be mediated by regular contact and information exchange between appropriate government officials and periodic meetings. Periodic high-level bilateral meetings should be considered.

3.1.8 Support Canadian right whale conservation areas.

Canada has established several conservation areas to protect right whales. To the extent that the protection of additional areas is sought, the United States should support and endorse such efforts.

3.1.9 Support efforts to collect and compile data on habitat use patterns (breeding, foraging, and migratory areas) for the eastern North Atlantic right whale population.

3.1.10 Collaborate with international authorities to protect important habitats (when and if identified) for the eastern North Atlantic right whale population.

### 3.2 Assess modifying critical habitat boundaries.

3.2.1 Analyze available data and collect additional whale sighting data as necessary to assess expanding or modifying the critical habitat boundaries.

There are sighting data that suggest that right whales occur with some regularity, but not in high numbers, outside designated right whale critical habitat. These data and historic data should be analyzed to assess whether whales occur outside the critical habitat in sufficient number to warrant expansion of the size of the critical habitat. In this regard, NMFS was petitioned in 2002 to revise the boundaries of the right whale critical habitat (see Critical Habitat section). The agency response to the petition (68 FR 51758, August 28, 2003) lists seven steps necessary to investigate those physical or biological features essential to the conservation of the North Atlantic right whale, and to propose any revisions to designated critical habitat that might be supported by new information and analysis. Thus, NMFS would have to complete at least the following steps to determine if revision is warranted:

- (1) In the waters off of the Southeast U.S., continue analysis of right whale distribution data in relation to bathymetry and sea surface

temperature derived from Advanced Very High Resolution Radiometer (AVHRR) imagery;

(2) In the waters off of the Northeast U.S., continue its own efforts, as well as collaborate with others working in the Gulf of Maine Ecosystem, to characterize the spatial and temporal distribution of zooplankton;

(3) Examine the available scientific information to assess whether other physical or biological features of the environment are essential to the conservation of the species;

(4) Identify those "specific areas within the geographical area occupied by the species, at the time it is listed..., on which are found" one or more of the physical or biological features determined to be essential for conservation;

(5) Evaluate the current or future special management considerations or protections relevant to the habitat features determined to be essential for conservation;

(6) Evaluate the economic and other relevant impacts of including any particular area in the designation of critical habitat, weigh these benefits and negative impacts, and determine whether exclusion of any area would lead to the extinction of the North Atlantic right whale; and

(7) Identify specific areas outside the geographical areas occupied by the North Atlantic right whale at the time it was listed, that are essential to the conservation of the species, and evaluate the impacts of designating any of these areas as critical habitat.

#### 3.2.2 If warranted, revise critical habitat boundaries.

If the historic and sighting data analysis indicate that a modification of the critical habitat boundaries is beneficial, then the boundaries should be revised.

### 3.3 Reduce Human Impact to Habitat

A number of human activities other than shipping and fishing may adversely affect right whale habitat. These include (in order of severity of potential impact) (a) coastal development (e.g., dredging); (b) anthropogenic noise; (c) contaminants; and (d) oil and gas exploration and development.

There are few data regarding the possible indirect adverse effects of these types of human activities on right whales. However, it is possible that certain activities that degrade right whale habitat may be slowing population recovery. Studies are needed to determine if various activities are impacting right whales and right whale productivity.

#### *Coastal Development*

3.3.1 Conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution, behavior, and productivity of right whales.



The activities and impacts studied should include, but not be limited to, sewage outfall, dredging activities (and associated plumes), dredge spoils, dumping, habitat alteration, noise, and aquaculture activities, including effects on prey species as well as on right whales directly.

3.3.2 As feasible, take steps to minimize identified adverse effects from coastal development.

#### *Anthropogenic Noise*

Human activities result in the introduction of substantial amounts of noise into the sea. No ocean basin is free of noise from human activities. Among the various sources, noise from ships may be the greatest and most ubiquitous. The level of sound from ships, virtually non-existent 100 years ago, has gradually but significantly increased in recent decades.

Numerous studies have been conducted on the effects of some types of noise on marine mammals. The results are equivocal. That is, the effects may be more dependent on the species and activity of the individuals than on the type, character, or amplitude of the sound. When engaged in vital behavior, such as feeding or courtship, whales may be relatively unresponsive to loud sounds. For example, in several studies bowhead whales showed little overt reaction when exposed to industrial noise (Richardson *et al.* 1995). However, many, perhaps all marine mammal species, are highly dependent on sound for such things as locating conspecifics, perhaps locating prey, and sensing their environment.

3.3.3 Conduct studies to assess the direct and indirect effects of anthropogenic noise on the distribution, behavior, and productivity of right whales.

Studies are needed to assess potential adverse effects of underwater noise (including ship noise) on right whales, including, but not limited to, disturbance of intraspecific communication, disruption of vital functions that are mediated by sound, distributional shifts, and stress from chronic or frequent exposure to loud sound. Noise sources studied should include, but not be limited to, industrial and shipping activities, oceanographic experiments, military related activities, and other human activities. Studies of the impacts of noise that themselves involve adding noise to the marine environment should be conducted with surrogate species and in areas well away from habitat occupied by North Atlantic right whales.

3.3.4 Take steps to minimize identified adverse effects to right whales from anthropogenic noise.

If studies demonstrate that right whale productivity or behavior is significantly affected by anthropogenic sounds, steps should be taken to reduce or eliminate the loud sound sources.

As indicated above, noise from ships may be a significant, but largely overlooked, sound source adversely affecting whales. Although a logistically and economically difficult issue to address, strategies to reduce ship noise should be designed if the studies indicate that ship noise significantly affects right whale productivity or behavior.

#### *Pollutants*

3.3.5 Conduct studies to assess the sources and levels of anthropogenic pollutants and assess their possible adverse effects on right whales and their habitats.

Anthropogenic contaminants may affect reproductive functions, suppress immune systems, or otherwise affect the health or productivity of right whales. Although there are no studies making such links in large whales, there is a possibility that such relationships exist. Therefore, studies should be conducted to determine if uptake and assimilation of contaminants are inhibiting the reproduction or productivity of right whales. Such studies should focus on, but not be limited to, heavy metals, endocrine disrupters, immune suppressors, pathogens, and their exposure levels, pathways, and effects.

Where possible, actions should be taken and studies planned in the near-term to assess contaminant levels. For example, right whale tissue should be routinely provided to the National Marine Mammal Tissue bank for subsequent analysis of contaminant loads. In addition, to the extent possible, comparative studies should be conducted with other systems (e.g., Southern Ocean) and whale species (e.g., bowhead and southern right whales) in which contaminant levels might be particularly high or low, and where the adverse effects of high contaminant levels might be implicated in health or reproductive anomalies. Right whale researchers globally should be encouraged to assume a unified approach to conducting and reporting necropsies, and tissue sample collection, with regard to sampling for contaminant analysis in particular.

Blubber and other tissue samples have been archived from at least nine recent necropsies and are currently stored by the U.S. Fish and Wildlife Service and the Woods Hole Oceanographic Institute. These tissues should be reviewed for suitability, and selected samples analyzed for PCBs, pesticides, and dioxins. Such samples should be analyzed in a way that allows estimation of systemic (body) burden in right whales and assessment of how this may differ from other mysticete species. Such analyses will also allow better interpretation of data on cytochrome P450 1A (a “biomarker” that may be indicative of physiological response to contaminant exposure) that could be generated from available fixed tissue samples from necropsies conducted in recent years.

In addition, right whale prey aggregations in the Gulf of Maine, Bay of Fundy, and Cape Cod Bay should be sampled and analyzed for PAH compounds and other contaminants, as compared to reference samples from Georges Bank

(offshore New England). Further, copepod samples should be analyzed from these three regions, and compared with similar analyses conducted on krill and copepod samples from selected southern right whale feeding habitat, such as South Georgia. Such samples could be obtained in collaboration with the British Antarctic Survey annual krill survey.

3.3.6. Take steps to minimize identified adverse effects from anthropogenic pollutants.

If studies indicate that contaminants in the marine environment are adversely affecting right whales, steps should be taken to reduce the sources of such contaminants.

3.3.7 Conduct studies of individual health and body condition as they may be related to accumulated contaminants.

It is possible that frequent or chronic exposure to adverse effects of human activities, or accumulation of contaminants results in stress or reduced "health" of individuals. Also, reduced habitat quality could be affecting the health of individuals or the productivity of the population. In studies of land mammals and humans, fertility was shown to be affected by an insufficiency or excess of body fat. Measurement of body fat thickness is becoming practical at sea. It appears that there may be little seasonal variation in blubber thickness in individual right whales, however there may be variation in blubber thickness between those that are and are not reproductively successful. Further research on this question is needed. In addition, studies should be done to better understand reproductive and systemic health in right whales. Such research should focus on both biopsy and necropsy samples.

#### *Oil and Gas Exploration and Development and other Industrial Activities*

3.3.8 Conduct studies to assess possible adverse effects of oil, gas, and hard mineral exploration and development and other industrial activities.

A number of studies have been conducted on the effects of oil and gas exploration and development, and associated seismic surveys and ship and aircraft disturbance on some large whale species, notably bowhead whales. There are data on gray whale response to seismic sounds. However, no such studies have been conducted on the potential adverse effects on right whales. Additionally, seismic survey equipment has undergone recent developmental changes which alter many aspects of the sound characteristics and scope of their projection, making comparisons between the new and old systems difficult, if not impossible. While there are no known plans to lease areas for oil and gas exploration and development where western North Atlantic right whales occur, the demand for oil may drive a future need. Therefore, before such plans are implemented, studies should be conducted on the potential adverse effects of these activities. As needed, studies should also be conducted on the potential effects of hard mineral exploration, and other industrial activities on right whales.

3.3.9 Take steps to minimize identified adverse effects from oil, gas, and hard mineral exploration and development.

If the studies reveal that adverse effects are likely, steps should be taken to restrict or prohibit such activities.

3.3.10 Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.

If areas where right whales occur are leased for mineral exploration and development, and mitigative or prohibitive measures are implemented, monitoring studies should be conducted to determine if the protective measures are effectively protecting right whales from adverse effects.

3.3.11 Assess and update, as necessary, existing contingency plans for oil and chemical spills in waters where right whales occur. Local, regional, and national authorities should all participate in the development of integrated plans.

Considerable quantities of oil and gas are moved by tanker in and near right whale habitat. The possibility of a spill is significant. While the overall effects of spilled oil on cetaceans is equivocal, it is likely that the direct or indirect (e.g., prey) effects would be substantial. Therefore, local, regional, State, and Federal authorities should work cooperatively to, as needed, update existing contingency plans already developed under the National Contingency Plan and to assess existing plans for adequacy in protecting right whales and their habitats. Authorities need to ensure the plans are integrated at various levels and that communication channels and spill response chains of command are clearly understood. Contingency plans should include, but not be limited to, strategies for containing and collecting spilled oil, monitoring the effects on whales in the area, stepped-up programs to detect oil and oil derivative uptake levels by sampling living and dead whales, and monitoring the effects on the distribution, abundance, and behavior of whales in the vicinity of the spill. NMFS is the lead agency in establishing appropriate guidelines for monitoring the effects on whales. It should also include clear specifications for which agencies, organizations, and personnel are responsible for responding to a spill.

### *Whale-Watching*

While the close approach of any boat has the potential to disturb a marine mammal and may result in a collision, there are few data or indications that whale-watching activities affect whale behavior. However, the industry is expanding and increased boat activities may affect whales in ways not presently apparent. Many, but not all, commercial whale-watch boat operators are among the most careful boaters with respect to whales and whale behavior. Some individuals of some large whale species are attracted to whale-watch vessels. In addition, there is the added advantage of whale-watching of exposing the general public to whales, especially if there is a conservation message contained in the information provided by naturalists. The 500-yard

no approach regulation has greatly curtailed whale-watching of right whales. Nonetheless, there is potential for adverse effects of whale-watching including the disturbance of vital behavior such as feeding and courtship inasmuch as boats may still watch from distances greater than 500 yards, whale watching may still occur in Canadian waters, and whale watch vessels pass into and through right whale habitat. At the time of this writing, NMFS is preparing regional guidelines with regard to whale watch, thrill craft and other vessels for certain areas and will propose developing regionally specific guidelines for operating these craft.

There are good indications that circling or low-altitude aircraft change the behavior of some large whale species, such as bowhead whales (Richardson *et al.*, 1995). This is particularly true of repeated passes. Therefore, prohibitions (under the MMPA) of circling, low altitude flight, and repeated passes by aircraft near right whales should be enforced.

#### 3.3.12 Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels.

Studies should be conducted on the potential adverse effects of whale-watching. The studies should be carefully designed with appropriate controls, and caution should be used in conducting studies from boats inasmuch as the study vessel itself may cause disturbance. If the studies demonstrate that whale-watch vessels have adverse behavioral effects, steps should be taken to limit or eliminate watching of right whales. In addition, recent collisions between whale-watch boats and a humpback and a minke whale have raised concern about the impact of whale-watching activities on large whales. Regulations should be considered, and guidelines developed regarding vessel speed near whales, and manner and distances of approaches.

The recent proliferation of high-speed whale-watch ships and ferries, particularly in the waters off the northeast U.S., represents a threat to right whales. The use of such craft should be closely monitored and if likely adverse effects are detected, use of the craft should be curtailed.

#### 3.3.13 Assess the effectiveness of existing restrictions on whale watching activities to determine whether more restrictive measures are necessary or less restrictive measures could be permitted.

If regulations are issued to limit whale-watching, the effectiveness of the restrictions should be closely monitored. If monitoring studies indicate that the measures are not effective in deterring disturbance of whales, further restrictions should be considered.

#### 3.3.14 Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.

Every feasible effort should be made to educate whale-watch vessel operators about safe distances and maneuvering relative to whales. In addition, efforts

should be made to educate recreational vessel operators about approach regulations and guidelines. Trained naturalists should accompany each commercial whale watch trip and programs should be established to train naturalists. Conservation messages should be an essential component of information provided to whale-watchers by naturalists and whale-watch boat operators. Information about right whales and relevant protective measures should also be conveyed to people who, for reasons other than whale-watching, visit the coast and go out onto the Atlantic Ocean. In some areas, the National Park Service's interpretive staff could provide valuable assistance in this regard.

### 3.4 Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales.

Like most animals, right whale distribution and habitat use is highly correlated to prey abundance and availability. However, studies are needed to better understand the relationship between right whale occurrence and prey abundance, density and distribution. Models and relevant field testing should be used to predict right whale occurrence relative to prey occurrence and density. This work may be tied to broader-scale modeling to predict right whale distribution from environmental variables (see Clapham 1999).

#### 3.4.1 Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.

Efforts to recover right whale populations will be closely linked to efforts to ensure that prey stocks are not adversely affected. In addition, an ability to predict prey occurrence will likely aid in predicting right whale occurrence; and shifts in prey abundance and density will likely lead to shifts in right whales' occurrence. If prey abundance or distribution is adversely affected by human activities, right whales will likely be affected as well. Therefore studies are needed (or expand on existing or past studies) to identify right whale prey species, occurrence, abundance, density, and availability. Such information may be derived from existing data or complement past or ongoing studies. However, it may also be necessary to conduct additional directed studies to address such questions.

#### 3.4.2 Review and refine energetic models to better understand right whale food requirements and feeding strategies.

Models of right whale energetics have been devised, but they are somewhat crude and do not include the latest information. Existing models should be revised or new ones developed to predict and better understand energy requirements (i.e., levels of energy intake required to sustain individuals and populations) of right whales. Such information will help to determine if right whales are at carrying capacity and whether the existing environment (including possible human influences) can sustain right whales.

#### 4.0 Monitor the status and trends of abundance and distribution of the western North Atlantic right whale.

Accurate and periodic assessments of western North Atlantic right whale abundance and trends in abundance are essential to any right whale recovery efforts and assessing the relative effectiveness of protective measures. Monitoring studies should be conducted periodically (at least once every three years). Additional protective measures should be implemented if studies indicate that the population size is static or decreasing.

##### *Status*

#### 4.1 Develop quantitative recovery criteria population models to determine extinction risk, and parameters to validate the model predictions.

Analyses will be developed to minimize the risk of down-listing or de-listing the North Atlantic right whale under the ESA. Therefore, multiple demographic models incorporating population abundance and trends, as well as natality/survival estimates and any threat specific mortality estimates, will be developed to inform the Recovery Criteria. These models will be additional to the analysis of extinction probability and consideration of the five listing factors currently included in the Recovery Criteria. Models will be validated through comparisons with independent indices of population status, such as population age structure, gender ratios, etc.

#### 4.2 Conduct a study or convene a workshop to determine the best methods for assessing western North Atlantic right whale status and trends, and to establish the optimal level of effort required.

Considerable effort has been expended on gathering data on right whales, and this information represents a vital foundation for continued assessment of the population. Nonetheless, there is a need to review assessment methods in light of recent developments in the fields of biology and statistics. In addition, an assessment of the level and distribution of survey effort required to achieve optimal assessment results is essential to ensure that field work is as efficient and as cost-effective as possible.

#### 4.3 Assess population size, survival rate and trends on a regular basis.

Western North Atlantic right whale abundance should be estimated at least once every three years (depending on the results of the study or workshop recommended above). The individual photo-identification database is perhaps the best source of information by which abundance can be estimated, but analytical methods and field effort should be designed for optimal results. Also, the techniques themselves used to determine abundance, status and trends need to be evaluated and, if needed, new or preferable techniques proposed. Population modeling should be conducted to assess status, trends, abundance, and vital rates (including reproduction and survivorship), but all such models must be biologically realistic.

##### 4.3.1 At least once every three years, review and evaluate data on western North Atlantic right whale status. Continue to review stock assessment at least annually in accordance with the MMPA. If needed, improve data collection and analysis methods.

Periodically, at least once every three years, the data should be evaluated to determine if they are as accurate and comprehensive as possible. If the evaluation indicates that the quality of the data, or the methods used for data storage or analysis could be improved, steps must be taken to improve data quality.

4.3.2 As necessary, develop and implement other programs necessary for population monitoring.

As noted above, the photo-identification database contains data best-suited for assessments of population size and trends in abundance. However, if superior assessment techniques are identified, or if alternative methods of analysis are identified, they should be used. The goal is to use the best possible and most accurate means of assessment.

### *Distribution*

4.4 Monitor right whale occurrence and habitat use pattern in known high-use areas.

To obtain the best possible information on right whale occurrence, abundance, and distribution, surveys in the following geographic areas should be conducted at appropriate intervals. Methods for surveys in the areas should be standardized and consistent.

4.4.1 Continue to conduct annual winter surveys for right whales off the southeastern U.S. coast.

Winter right whale surveys off the coasts of Georgia and Florida provide important information on occurrence, abundance, and distribution during the breeding and calving season.

4.4.2. Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.

Summer right whale surveys in Canada's Bay of Fundy provide important information on occurrence, abundance, and distribution during the foraging season. Information collected through survey efforts on right whale distribution in these waters contributed significantly to Canada's 2002 conservation action to shift commercial shipping lanes in the Bay of Fundy toward areas of lower right whale density.

4.4.3. Continue annual spring surveys for right whales in the Great South Channel.

Spring right whale surveys in the Great South Channel not only provide important information on occurrence, abundance, and distribution during the foraging season, but contribute to a better understanding of how right whales use designated critical habitat. In addition, surveys in these waters, as



opposed to coastal habitat areas, generate data on right whale offshore behavior and distribution.

#### 4.4.4 Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.

Winter/spring right whale surveys in Cape Cod and Massachusetts bays provide important information on occurrence, abundance, and distribution, and contribute to a better understanding of how right whales use designated critical habitat.

#### 4.4.5 Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.

Summer and fall surveys on the Scotian Shelf, extending from Browns Bank in the west to the Laurentian Channel in the east, are important to determine right whale occurrence, abundance and distribution in Canadian coastal waters. Right whales occur regularly in Roseway Basin at the western margin of the Scotian Shelf, but little is known about their occurrence and distribution east of Roseway. This area has historically been the subject of little or no survey effort; however, recent surveys initiated in these waters yielded numerous right whale sightings and identification of individuals. Data collected from the NMFS 2002 Scotian Shelf survey were submitted to Canada to support a campaign to create an International Maritime Organization mandated "Area To Be Avoided" in Roseway Basin. These data were particularly useful given the lack of information from this area in recent years; results from the survey demonstrate that the Scotian Shelf continues to be an important right whale habitat.

#### 4.4.6 As often as possible and where feasible, photo-identification photographs should be obtained at each sighting.

Photo-identification is used for the purpose of identifying individual animals and clarifying population structure. Characteristics such as callosity patterns, scarring, body condition and shape, coloration, fluke structure, and lesions contribute to the visual identification of individual right whales. Photo-identification should be used as a standard data-collection tool during right whale surveys whenever possible.

#### 4.4.7 Conduct studies to locate unknown high-use areas for this population.

The location of the majority of right whales in winter is unknown, and substantial portions of the population are unaccounted for at other times. In addition, a significant number of mothers observed in the southeastern U.S. do not take their calves to the Bay of Fundy during summer; whether they migrate to a second, unknown nursery area, or simply have a more scattered distribution in shelf or other waters, is unclear. In these various unidentified locations, right whales may be exposed to threats from human activities. Therefore, identifying and studying such areas would be very valuable, and studies should be conducted to determine the location of such areas. For

example, historical data indicate and recent data confirm that right whales use waters off mid-Atlantic states to some extent at least in some years. Surveys should be conducted for a number of years to determine the extent of right whale occurrence in these areas of high vessel traffic and fishing effort. Satellite tracking studies may be useful in determining where these areas occur, but other methods should also be considered as appropriate. These include review of historical records, and the use of predictive models based on environmental data.

#### 4.4.8 Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, review of historical data, and results of predictive models.

When currently unknown habitats are identified, studies should be conducted to learn more about residency times, migration routes, and the demographics of the whales using these locations. Such studies should be based on ship or aircraft surveys or through satellite tracking studies. The habitats should be characterized and any human activities likely to adversely affect the whales identified and addressed appropriately.

#### 4.4.9 Conduct surveys and/or support efforts to determine eastern North Atlantic right whale occurrence in coastal waters off northern Europe and northwestern Africa.

Current abundance, distribution and migration patterns are unknown for eastern North Atlantic right whales based on a lack of sighting information. Following intensive periods of historical whaling in the Bay of Biscay, Cintra Bay, coastal Iceland, and the British Isles, right whales have only been sighted sporadically in eastern North Atlantic coastal waters. Ship or aircraft surveys should be conducted to determine the status of this population; in particular, coastal waters off the Hebrides, Shetlands, and Ireland may warrant investigation as important habitat usage areas.

#### 4.4.10 Continue to maintain a database of right whale sightings.

Any assessment of right whale abundance and distribution is dependent upon reliable and current information about sighting locations. Therefore, the existing (and historic) sighting database should be maintained. As feasible, efforts should be made to ensure that all right whale sighting information is included in the database. Because “negative data” (i.e., data indicating that despite search effort, right whales were not found to be present) are also important in defining distribution patterns, the database should include data from surveys in which right whales were not the target species.

### 4.5 Maintain a Photo-identification Database

As indicated elsewhere in this plan, the individual photo-identification database is one of the most valuable sources of information by which status and trends in abundance can be estimated. Whereas, violation of certain assumptions may complicate the use of “mark-recapture” types of analyses, photo-identification data provide minimum

population values, trends in such values, survivorship, and other information. The database and its resulting catalog should be maintained and routinely updated with new photographs. The ways in which data are stored, analyzed, and made available to researchers should be assessed periodically (at least every three years) to identify ways to improve these processes.

#### 4.5.1 Maintain and routinely update the right whale photo-identification catalog.

The catalog of individually identified whales should be maintained and kept current, new additions processed as quickly as is feasible, and all researchers or other field workers encouraged to make timely submissions of all photographs of right whales.

#### 4.5.2 Require, as a condition of permits provided under the ESA or MMPA, that researchers conducting field work on right whales provide at the earliest convenience photographs (and ancillary information) obtained from their studies to the curators of the photo-identification catalog.

Rather than relying on voluntary submissions from permitted researchers, photographs should be required as a condition of permits to ensure that the right whale photo-identification catalog is as comprehensive and accurate as possible.

#### 4.5.3 Regularly and consistently review, evaluate, and update analyses of data in the right whale photo-identification catalog.

The photo-identification catalog is an important tool for study of western North Atlantic right whale demographics. It is essential that the database be mined for specific types of analyses and to address specific questions. Neither a backlog of processing photographs for cataloging nor delays in providing photographs to the database should be factors in limiting critical analysis. For these reasons, the process for handling photographs, maintaining the database, the types and quality of analyses should be assessed, and improved as needed, at least once every three years.

NMFS should require that all photographs of right whales that are suitable for photo-identification of individuals be provided as soon as possible to those maintaining the catalog for inclusion in the data base.

#### 4.5.4 Conduct studies to determine population structure using photo-identification data.

Additional information on population structure will aid management efforts to recover the species and provide necessary information to monitor right whale status, abundance, and distribution. Field studies assessing population structure should continue to use the tool of photo-identification; information from the existing catalog should also inform these studies.

### 4.6 Respond to Strandings

#### 4.6.1 Continue and improve program for necropsy of right whale carcasses.

The existing program supported by NMFS and, in general, carried out by contractor and a dedicated group of volunteers – the Marine Mammal Stranding Network – is quite good and should be continued. Response to a stranding is generally quick and sampling thorough. However, there may be ways to improve the system. For example, it may be possible to identify steps to increase response or improve coordination of tissue sampling and disseminating data. Reliable sources of funding need to be established to ensure that every carcass is necropsied and that correct procedures are used.

#### 4.6.2 Review and, if needed, improve procedures for responding to reports of dead right whales and conducting necropsies to ensure that the most effective means are being used to extract scientific information from dead, stranded, and entangled right whales.

Each right whale carcass represents an important opportunity for scientific investigation of the cause of death, and for addressing questions on life history, and such matters as contaminant loads. Delays in attempts to secure or examine a carcass can result in the loss of valuable data, or even of the carcass itself. Every possible effort should be made to respond to and recover as much data as possible from each right whale carcass. The Stranding Network coordinator should work with appropriate agencies, organizations, and individuals to ensure that, when a right whale carcass is reported it is rapidly secured and: (i) a necropsy is performed as rapidly and as thoroughly as possible by qualified individuals selected to gather information regarding the cause of death; (ii) samples are taken and properly preserved for studies of genetics, toxicology, and pathology; and (iii) funding is available to notify and transport appropriate experts to the site rapidly and to distribute tissue samples to appropriate locations for analysis or storage. In addition, the coordinator should work with stranding networks and the scientific community to develop and maintain a database for tissue samples requested by qualified individuals and agencies, and ensure that these samples are collected routinely from each carcass and stored in appropriate locations or distributed to appropriate researchers.

#### 4.6.3 Improve or, as necessary, develop and implement protocols for securing and retrieving stranded or floating right whale carcasses.

The detection and reporting of dead right whales, whether stranded or floating at sea, need to be encouraged in every way possible. The Large Whale Recovery Program coordinator and the National Marine Mammal Stranding Network coordinator should continue working with representatives of local, State, and Federal agencies, private organizations, academic institutions, and regional and national stranding networks to facilitate efficient coverage and information exchange. In areas where protocols do not exist, they should be developed. The responsibilities of all relevant agencies, organizations, and individuals should be clearly defined. Contingency plans should be developed for retrieval of right whale carcasses along the entire U.S. east coast, including

the identification and securing of sites to bring carcasses ashore, conduct necropsies, and dispose of waste.

Right whales may die at sea, but not be detected or reported. Mariners, including Navy and Coast Guard personnel, commercial and recreational boaters, and fishermen might observe carcasses at sea but not recognize the importance of their observation. This was highlighted by a recent (2001) incident in which a South Carolina mariner observed and photographed the carcass of a right whale calf floating off the coast of Myrtle Beach, South Carolina. The incident was not reported until nearly a month later, too late to retrieve the carcass. Mariners must be educated about the importance of retrieving such carcasses so that as much information as possible can be gleaned from them.

4.6.4 To the extent possible, use necropsies to determine the cause of death and use such data to reduce the susceptibility to death from these causes.

Assessment of the causes and frequency of mortality (either natural or human-caused) is important to understanding population dynamics and the threats that may impede the recovery of western North Atlantic right whales. For example, it may be possible to employ certain types of forensics to characterize propeller wounds, identify and the types of ships responsible for ship strikes, and perhaps even extrapolate to describe a whale's behavior at the time of a collision. Accordingly, the efficiency of efforts to detect and investigate right whale deaths should be maximized.

4.6.5 Analyze tissue collected from stranded right whales to determine and monitor contaminant levels.

As noted earlier, certain contaminants if found in particularly high levels, may lower productivity in right whales by inhibiting reproductive functions, increasing susceptibility to disease, or through other mechanisms. To monitor contaminant levels and possible changes in levels and to possibly assess likely effects on the population, programs should be developed to collect appropriate tissues from dead and stranded individuals. Also, all existing samples need to be located and analyzed. Proper and standardized techniques should be used to store and analyze the tissue for various anthropogenic contaminants. The program (i.e., the tissue to be collected, the storage and data analysis methods) should be designed and carefully implemented in conjunction with the National Marine Mammal Stranding Network Coordinator and the Marine Mammal Stranding Network..

If contaminant levels are found or suspected that may result in inhibiting reproductive functions or productivity, a program should be developed immediately to identify the origins of the contaminants and to eliminate or reduce the sources.

4.6.6 Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales.

The types of reproductive and life history information that can usefully be obtained from such examinations include age at death, reproductive status such as maturity, indicators of recent pregnancies, diet analysis, and causes of morbidity.

4.6.7 Review, analyze, and summarize data on stranded right whales on a regular (at least annual) basis.

Current and complete data on stranding events and the data derived from them is essential to ongoing protective measures. Summaries should include, but not be limited to, timely assessments of the cause of death and, where applicable, the type(s) of fishing gear involved if fishing operations resulted in the death of the animal.

4.6.8 Develop and implement a program for handling live-stranded right whales.

Rehabilitation of live-stranded right whales will likely be feasible in very limited circumstances. For example, rehabilitating a fully mature adult is probably nearly impossible given the size of the animal and difficulties involved in transporting and caring for it. It may be possible to rehabilitate and release a live-stranded calf if it were in sufficiently good shape at the time of the stranding. In some cases, euthanasia may be more appropriate.

4.6.9 Develop protocols for handling live-stranded right whales, including identification and securing of appropriate sites to effect rehabilitation.

Attempting and effecting a rehabilitation requires advance planning including decisions regarding, but not limited to, appropriate facilities, logistics, and equipment to be used. These are likely to be regionally specific. Such matters should be worked out in advance, with responsibilities clearly understood.

4.6.10 Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.

As noted above, collection of information from right whale carcasses is essential to recovery efforts. Therefore, identifying and committing to predictable sources of funding for completing these tasks is also critical.

#### 4.7 Conduct Habitat Use Studies (using telemetry)

4.7.1 Where feasible, effective, and minimally intrusive, conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and behavior.

Telemetry studies are among the most useful tools available for answering questions about right whale ecology, habitat use, movements, and migrations. For example, telemetry is probably the quickest way to identify and delineate previously unrecognized high-use areas where protective measures should be implemented. Also, real-time information on whale locations can be key to

reducing right whale interactions with fishing and shipping activity. However, there are legitimate concerns about the potential risks to the whales, e.g., infections at the site of tag attachment. Such risks are not well understood and need to be assessed. It needs to be clear that the benefits of tagging and telemetry studies outweigh any potentially negative impacts. If such a cost-benefit evaluation indicates that the tagging and telemetry work is justified, carefully designed and executed, minimally intrusive studies should be conducted to address uncertainties with regard to patterns of right whale habitat use, movement, migration, and areas of aggregation.

4.7.2 Conduct studies to assess the most effective and least intrusive means of tagging right whales, including the possibility of using other species as models.

Whereas there are no known risks to telemetry studies of large whales, as noted above, implanted tags have the potential to cause infection or have other adverse effects. Telemetry studies have the potential to provide important, perhaps vital, information for the protection of right whales, and should be regarded as an important tool in doing so. However, the benefits must outweigh any possible negative impact. Studies should be conducted to determine if adverse effects result from tagging studies. Other closely related but more abundant large whale species (e.g., the southern right whale) may serve as valuable surrogate subjects for such study.

4.7.3. Conduct studies by veterinary experts to assess short- and long-term physiological impacts of tagging.

See narrative above (4.7.2). Given their specialized background, health or veterinary science experts should be sought to conduct or participate in studies to determine right whale physiological response to tagging and potential associated negative impacts.

4.7.4 Continue and expand satellite-linked radio-tagging and tracking to identify right whale movements and habitat use patterns more effectively.

Improved knowledge of right whale locations, movements, and habitat use provided through telemetry studies may provide important information in the effort to reduce human impacts. Such studies should be conducted assuming individual health risks are deemed to be insignificant or non-existent.

4.7.5 Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats

Comments under 4.7.1 and 4.7.2 apply here as well.

4.7.6 When satellite tags are transmitting, conduct monitoring surveys to check for other right whales in the area of the tagged whale.

Other right whales may be present in the area of a tagged whale (when engaged in socializing, mating, or foraging in a dense prey patch, for example,

more than one individual may be found in association). Surveys should be carried out to monitor areas in the vicinity of tagged whales; if additional whales are found, real-time information should be collected to identify individuals, record behavior, and note habitat usage.

4.7.7 Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas

Comments under 4.7.1 and 4.7.2 apply here as well.

#### 4.8 Assess Demography and Stock Structure

4.8.1 Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success.

Genetic studies have the potential to provide extremely valuable information on population structure, abundance, genetic variability, effective population size and social structure. In the case of the western North Atlantic right whale, since much of the population has been biopsy sampled, it should be possible to obtain a level of detail which is unthinkable for most mammalian populations. Past and ongoing work has used mitochondrial and microsatellite DNA to investigate the genetics of this population. This work should be continued and expanded to include additional microsatellite loci in order to provide a detailed characterization of the population, and to assess effective population size and the degree of inbreeding. In addition, genetic information from any members of the vestigial eastern North Atlantic right whale population, if possible to obtain, would be of immense interest in establishing the relationship between the populations.

4.8.2 Conduct genetics workshop.

A workshop should be convened to discuss genetic data needed for recovery of the species, and optimal methods for analysis of genetic data.

4.8.3 Conduct studies of population demographics, including but not limited to such features as calf production, survivability, and age structure.

Indicators of the status and overall health of the population can be derived from a number of indices, including such things as calf production rates, and adult and calf survivability. Studies of population demographics should be conducted to help assess biological features that may be (or may not be) contributing to recovery.

#### 4.9 Reproduction and Health Assessment

As noted above, calf production in the western North Atlantic right whale DPS has fluctuated rather widely in the last two decades (a range of one calf in 2000 to 31 calves in 2001). In addition, the mean calving interval is apparently increasing. The



variation and relatively low overall reproductive output of this population may be directly or indirectly linked to human activities.

4.9.1 Conduct studies to determine the cause(s) of anomalous or fluctuating reproductive rates.

There are no known reasons for the variation in productivity, however, contributing factors may include ecosystemic fluctuations (e.g., prey density or availability), individual health, habitat degradation, or disturbance from human activities. Studies need to be conducted to investigate the causes of this variation and to identify possible explanations for anomalies.

4.9.2 If cause(s) of reproductive anomalies are linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

Low productivity may be directly or indirectly linked to contaminants, disturbance, habitat degradation or other factors resulting from human activities. If such factors are related to low right whale productivity or reproductive anomalies, programs should be established to reduce or eliminate the impact to right whales.

4.9.3 Conduct studies to assess health at the individual and population level.

As noted above, reproductive anomalies may be linked to poor individual health, which may in turn be linked to poor nutrition, disturbance or disruption of vital activities by human activities, or other factors. In addition, recently reported skin lesions in some individuals may be linked to poor health and caused by some heretofore unidentified etiological agent. In addition, entanglement in fishing gear may reduce an individual's general or reproductive fitness and such impacts to the population should be examined. Therefore, studies need to be conducted to assess right whale health both at the individual level and the population level, particularly as they pertain to reproduction.

4.9.4 If studies indicate that poor individual or population health is linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

Human activities such as the release of toxic effluents, disturbance from vessels or whale watching activities, alteration of habitat or food webs may directly or indirectly cause lowered health and productivity in right whales. If poor health is linked to human activities, programs need to be established to reduce or eliminate their impact to right whales.

5. Coordinate Federal, State, international, and private efforts to implement the Recovery Plan.

5.1 Continue international ban on hunting and other directed takes of right whales.

Directed hunting in the past is the reason for the current dismal status of right whales. Although western North Atlantic right whales are no longer a target of whaling, the hunting of western North Atlantic right whales should not be permitted to resume under any circumstances. The population is too small to sustain any type of directed take. Also, even if a sustained growth and apparent recovery were to occur, hunting should not be permitted, as this population is clearly vulnerable to extirpation and has not demonstrated an ability to sustain commercial levels of take in addition to all the other sources of right whale mortality present in the environment.

## 5.2 Enforce right whale protection laws.

Existing legislation and its implementing regulations that protect right whales should be enforced by the appropriate agencies. It is necessary to establish and conduct monitoring programs to determine the level of compliance with these laws. If there are indications that regulations are not being enforced, enforcement regimes need to be improved. Appropriate agencies should be encouraged to obtain and provide adequate resources needed to ensure regulations are adequately enforced. In addition, NMFS needs to continue to request and conduct consultations under Section 7 of the ESA with all Federal agencies and on any Federal action that may jeopardize right whales or adversely modify critical habitat.

## 5.3 Evaluate the effectiveness of the Northeast and Southeast Implementation Teams and implement improvements as warranted.

The recovery plan implementation teams are charged with providing advice to, and support of, recovery activities, particularly those undertaken by NMFS. The mandate, goals, responsibilities, membership, and effectiveness of these teams should be evaluated, and ways to make them more effective should be identified. Specific terms of reference and objectives should be identified for each team, together with tasks, priorities and a timetable for their completion. Team membership and activities should subsequently be revised accordingly.

## 5.4 Coordinate with States involved in right whale activities to maximize protection measures.

A number of State programs include significant and rigorous right whale protective measures. Such programs need to be supported and steps taken to ensure they dovetail with other State and Federal programs. Although some inter-agency coordination takes place in right whale recovery plan implementation teams and to some extent through the Atlantic Large Whale Take Reduction Team, increased efforts need to go into, for example, meeting regularly with State representatives and seeking to develop cooperative research and management programs. In addition, NMFS should negotiate and conclude cooperative agreements, under Section 6 of the ESA, with States agencies involved in right whale protective programs.

## 5.5 Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales, reduce human-related mortality and injury, report mortality events, promote protection of habitat, and take other measures to enhance the recovery of right whales.

5.5.1 Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures.

Western North Atlantic right whale distribution is transboundary. Successful protective measures involve cooperative bilateral efforts between NMFS, the Canadian Department of Fisheries and Oceans and other responsible and interested entities. Canada has prepared a right whale recovery plan and efforts should be made to ensure that the Canadian and U.S. plans dovetail, and that efforts are being taken cooperatively. One way to achieve this goal is to convene regular meetings between the two nations and develop follow-up actions.

5.5.2 Promote actions to enhance protection for known areas of importance, especially vessel and fishery interaction issues in Canadian waters.

Bi-lateral protection measures and cooperative steps identified in periodic bi-lateral meetings should be acted upon.

5.6 Periodically review and update the North Atlantic Right Whale Recovery Plan.

The effectiveness of this plan should be reviewed in conjunction with the five year status review of the species, and revised as necessary. The activities identified in this plan should be reviewed to determine if they are being successfully implemented and whether they are still the most effective means of achieving recovery. If high priority actions are not being pursued, steps need to be taken to remedy this. If appropriate, new actions and priorities should be identified and implemented.

5.7 Prepare post-delisting monitoring plan for species before delisting occurs.

As delisting of the species approaches, a plan should be in place for monitoring the status of the species after de-listing occurs, as specified in the ESA. The plan should monitor the status of the species itself, the threats to the species (to ensure they aren't recurring), implementation of regulatory mechanisms, and the existence upon which the delisting relied. Monitoring required after delisting is likely to be a subset of studies conducted when the species was listed. As such, protocols should anticipate that pre-delisting monitoring sets a baseline for post-delisting monitoring, and a post-delisting monitoring plan should be in place well before delisting to ensure the adequacy of baseline information. A post-delisting monitoring plan should be developed several years before achieving delisting criteria is anticipated.

## **V. IMPLEMENTATION SCHEDULE**

An implementation schedule is used to direct and monitor implementation and completion of recovery tasks. Priorities in column 2 of the following implementation schedule are assigned as follows:

Priority 1 – An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2 – An action that must be taken to prevent a significant decline in population numbers or habitat quality, or to prevent other significant negative impacts short of extinction.

Priority 3 – All other actions necessary to provide for full recovery of the species.

Funding is estimated according to the number of years necessary to complete the task once implementation has begun. The provision of cost estimates is not meant to imply that appropriate levels of funding will necessarily be available for all right whale recovery tasks. Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the implementation schedule. The listing of a party in the implementation schedule does not require the identified party to implement the action(s) or to secure funding for implementing the action(s). The costs associated with the various recovery tasks listed below are for those to be implemented in U.S. waters only. Costs associated with promotion of international action have not been estimated.

### North Atlantic Right Whale Population Implementation Schedule

Action Number	Action Description	Priority	Duration (yrs)	Agencies/ Organizations Involved	Fiscal Year Cost Estimates (thousands of dollars)				
					FY 1	FY 2	FY 3	FY 4	FY 5
<b>Objective 1</b>	<b><i>Minimize sources of human-caused death, injury, and disturbance</i></b>								
<b>1.1</b>	<b>Reduce ship collisions with right whales</b>								
1.1.1	Develop and implement a ship strike reduction strategy	1	Ongoing	NMFS, USCG	2000	2000	2000	1500	1500
	<i>Sighting Advisory System</i>								
1.1.2	Continue seasonal aircraft surveillance of right whale habitats and other elements of the “early warning system” program.	1	Ongoing	ACOE, NMFS, States, USCG, USN	600/#	600	600	600	600
1.1.3	Provide right whale sighting locations to mariners.	1	Ongoing	ACOE, NMFS, States, USCG, USN	*	*	*	*	*
1.1.4	Notify individual ships directly when their course is likely to bring them to or near a location where a whale was sighted by the aircraft.	1	Ongoing	NMFS, States, USCG, USN	*	*	*	*	*
1.1.5	Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes.	2	Annual Ongoing	NEIT, NMFS, SEIT, States	*	*	*	*	*
1.1.6	Standardize surveys and data collection to ensure data obtained from the surveys are of maximum use.	2	1	NEIT, NMFS, SEIT, States	*				

### North Atlantic Right Whale Population Implementation Schedule

1.1.7	Establish a program for regular and timely analysis of aircraft survey data.	2	3	NMFS, States	*	*	*		
1.1.8	Use acoustic detection technology, surveys, and other technologies to monitor right whale occurrence and distribution in the mid-Atlantic United States.	1	5	NMFS, States	100	150	80	80	80
1.1.9	Develop a system to encourage, collect, and appropriately analyze opportunistic sightings from fishing vessels, whalewatching vessels, charter vessels, etc.	2	ongoing	NMFS, States	30	30	40	40	50
1.1.10	Collect standardized data during aerial surveys on “close calls” between ships and whales	1	ongoing	NMFS, States	20	20	25	25	30
	<i>Vessel Traffic Management</i>								
1.1.11	Assess the utility and feasibility of ship routing changes in right whale habitat.	1	2	DFO, MMC, NEIT, NMFS, SEIT, States, USCG	60	25	-	-	-
1.1.12	Assess the possibility of speed restrictions in right whale habitat.	1	1	DFO, MMC, NEIT, NMFS, SEIT, USCG	-	15	-	-	-
1.1.13	Conduct risk assessment analyses of various ship routing or speed options to assess best set of vessel traffic management options by area.	2	2	DFO, MMC, NEIT, NMFS, SEIT, USCG	40	25	-	-	-
1.1.14	Assess the potential economic impact of vessel management options.	3	3	DFO, NEIT, NMFS, SEIT, USCG	50#	25	10	-	-

### North Atlantic Right Whale Population Implementation Schedule

1.1.15	Work with mariners, the shipping industry, and appropriate State and Federal agencies to develop and implement a regionally-based set of measures to reduce the threat of ship strikes.	1	5	NMFS, NEIT, SEIT, USCG	40	40	30	20	20
1.1.16	Assess the effectiveness of ship strike measures and adjust, as necessary.	1	5	NEIT, NMFS, SEIT, USCG	40	30	20	20	20
	<i>Education and Outreach</i>								
1.1.17	Establish regionally-based liaison positions to work directly with the shipping industry.	2	5	NMFS, NEIT, SEIT, States, USCG	200	200	200	200	200
1.1.18	Develop programs and materials to educate mariners about right whales and recommended practices for avoiding ship strikes, Make provisions for ongoing distribution of materials.	2	ongoing	ACOE, NMFS, NEIT, SEIT, States, USCG	50	30	25	20	20
1.1.19	Review and update information about right whale habitat and high-use areas, vulnerability to ship strikes, and ship collision reduction measures on nautical charts, <i>Coast Pilots</i> , <i>Notice to Mariners</i> , and other navigational aids.	2	ongoing	DFO, NIMA, NMFS, NOS, USCG	*	*	*	*	*
	<i>Mandatory Ship Reporting System</i>								
1.1.20	Continue to implement mandatory ship reporting systems along the east coast of the United States.	1	ongoing	NMFS, USCG	+	200	180	150	150

### North Atlantic Right Whale Population Implementation Schedule

1.1.21	Use incoming information from the reporting system for analysis of ship volume and routing studies to assess measures to reduce ship/whale interactions.	2	ongoing	NMFS	75	60	60	60	60
1.1.22	Assess the effectiveness of existing ship reporting systems and reporting areas.	2	ongoing	NMFS, USCG	25/#	25	20	20	20
1.1.23	Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.	2	ongoing	NMFS, USCG, NEIT, SEIT	20	20	20	10	10
1.1.24	Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.	2	ongoing	NMFS, USCG, NEIT, SEIT	30	20	15	10	10
	<i>Whale Detection Technology</i>								
1.1.25	Conduct studies of active and passive acoustic devices to determine their feasibility and efficiency in detecting submerged whales.	1	4	NMFS, USN	80	100	100	80	-
1.1.26	Implement systems to use technological devices to reduce ship/whale interactions if they are capable of detecting submerged whales, Conduct studies to assess acoustic pollution impact on marine mammals.	1	5	NMFS, USN	100	150	200	150	150
1.1.27	Assess the utility of such devices on large scales.	2	3	NMFS, NOS, USN	80	100	80	-	-



### North Atlantic Right Whale Population Implementation Schedule

1.1.28	Conduct studies of whale behavior relative to various types of “alerting” sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships.	3	3	NMFS, USN	30	30	25	-	-
1.1.29	Assess the feasibility of improved visual detection technologies.	2	3	NMFS, USN	30	30	20	-	-
1.1.30	Assess the feasibility and utility of using remote sensing to characterize right whale distribution patterns.	2	2	NESDIS, NMFS, NOS, USN	80	80	-	-	-
	<i>Geographic Information Systems</i>								
1.1.31	Conduct GIS analysis of whale/ship interactions.	2	ongoing	NEIT, NESDIS, NMFS, SEIT, States	*	*	50	50	50
1.1.32	Establish or use existing GIS to (a) conduct analysis of right whale occurrence and distribution, (b) prepare predictive models of occurrence, (c) determine right whale and ship traffic overlap, (d) analyze patterns of strandings, whale/vessel interactions, and “near-miss incidents”; and (e) assess ways to minimize ship/whale interactions.	2	5	NESDIS, NMFS, NOAA, USN, States	100	100	80	80	80
1.1.33	Identify, and obtain data from, additional sources for GIS application and analysis.	3	3	NEIT, NESDIS, NMFS, NOAA, SEIT, States	40	15	10	-	-
	<i>Ship Noise and Whale Behavior</i>								
1.1.34	Conduct studies of whale responses to ship noise and to ships of various types and speeds using benign techniques.	1	3	NMFS, USN	60	80	50	-	-

## North Atlantic Right Whale Population Implementation Schedule

	<i>Monitoring</i>								
1.1.35	Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.	2	ongoing	NMFS, States	40/#	40	40	40	40
<b>1.2</b>	<b>Reducing Fishing Gear Entanglement</b>								
	<i>Operations</i>								
1.2.1	Develop and implement strategies to modify fishing operations and gear to reduce the likelihood of entanglement, mitigate the effects of entanglements, and enhance the possibility of disentangling, and assess the effectiveness of such strategies.	1	ongoing	ALWTRT, NMFS, States, USCG	*	*	*	*	*
1.2.2	Conduct research on alternative fishing methods. Implement methods that offer entanglement risk reduction.	1	4	ALWTRT, NMFS, States	80	70	50	20	*
1.2.3	Work with Canadian officials to develop means to reduce entanglement levels in Canadian waters.	1	ongoing	DOS, NMFS	*	*	*	*	*
	<i>Gear</i>								
1.2.4	Conduct studies of gear modifications that reduce the likelihood of entanglement.	1	5	ALWTRT, NMFS, States	350/#	250	220	100	85

### North Atlantic Right Whale Population Implementation Schedule

1.2.5	Design and implement programs to incorporate gear modifications that reduce entanglement into the fisheries operations.	1	ongoing	NMFS, States	100/#	80	60	30	30
1.2.6	Develop and implement schemes to reduce the rate at which gear is lost.	2	3	NMFS, States	80	80	50		
	<i>Reporting</i>								
1.2.7	Continue to prepare and distribute information on whale entanglement to fishermen and other mariners.	1	ongoing	ALWTRT, NMFS, States, USCG	15/#	20	15	5	5
1.2.8	Continue, expand, and improve, procedures for responding to reports of entangled whales.	1	ongoing	ALWTRT, NMFS, States, USCG	*/#	*	*	*	*
1.2.9	Expand fisheries observer programs.	2	5	ALWRT, NMFS,	180	250	300	350	350
1.2.10	Continue to review, evaluate, and act upon reports from fishermen and fishery observers of fishery interactions with right whales.	2	ongoing	NMFS, States, USCG	*/#	*	*	*	*
1.2.11	If evaluations indicate that reporting can/should be improved, implement improved systems for reporting.	2	5	ALWTRT, NMFS, States	15	15	10	10	10
	<i>Disentanglement</i>								
1.2.12	When possible and practicable in terms of safety, disentangle whales caught in fishing gear.	1	ongoing	NMFS, USCG	400/#	400	300	200	200

### North Atlantic Right Whale Population Implementation Schedule

1.2.13	Create and maintain regional disentanglement equipment caches and make appropriate arrangements to get disentangling teams and equipment to entangled whales.	1	ongoing	NMFS, USCG	35/#	20	15	15	10
1.2.14	Develop and train additional disentanglement response teams.	1	5	ALWTRT, NMFS	60/#	60	50	50	30
1.2.15	Design and conduct studies on advanced disentanglement gear.	1	3	NMFS	15	10	5	-	-
1.2.16	Identify and implement ways to improve disentanglement efforts.	1	5	NMFS, States	15	20	20	15	15
	<i>Monitoring of Entanglement Rates and Evaluation of Protective Measures</i>								
1.2.17	Monitor entanglement-related survival and mortality rates.	1	ongoing	NMFS, States	15	15	15	10	10
1.2.18	Determine whether measures to reduce entanglement are effective.	1	5	NMFS	50/#	50	30	30	30
1.2.19	Identify and implement steps to improve protective measures.	1	5	NMFS	50	80	100	100	100
	<i>Photo-identification Data Analysis</i>								
1.2.20	Review and evaluate stranding and photo-identification data to monitor interactions with fishing gear and effectiveness of mitigation measures.	2	ongoing	NMFS	200	210	220	230	240
<b>1.3</b>	<b>Continue and Improve Education and Outreach Programs</b>								

## North Atlantic Right Whale Population Implementation Schedule

	<i>Providing Relevant and Timely Information</i>								
1.3.1	Continue and expand efforts to educate shipping and fishing industries about right whale vulnerability to ship strikes and fishing gear entanglement.	1	ongoing	NEIT, NMFS, NOS, SEIT, States, USCG, USN	80	70	60	50	50
1.3.2	Ensure that right whale protective measures are incorporated and updated in the international Safety Management Code and Coast Guard training course for vessel auditors and inspectors.	1	ongoing	NMFS, USCG	*	*	*	*	*
1.3.3	Use voyage planning and merchant mariner qualification and licensing programs to raise awareness regarding right whale conservation.	2	ongoing	NMFS, USCG	30	30	25	25	25
<b>1.4</b>	<b>Enforcement</b>								
1.4.1	Continue and improve programs to ensure that fishing and shipping regulations are enforced.	1	ongoing	NMFS, States, USCG	200	200	200	200	200
1.4.2	Review and assess the efficacy of the enforcement programs and take steps to improve the enforcement measures if deficiencies are identified.	2	ongoing	NMFS, USCG	60	80	80	80	85
<b>Objective 2</b>	<b><i>Develop demographically-based recovery criteria</i></b>	1	2	NMFS	*	*			

### North Atlantic Right Whale Population Implementation Schedule

<b>Objective 3</b>	<b><i>Identify, characterize, protect, and monitor important right whale habitats</i></b>								
<b>3.1</b>	<b>Characterize and Monitor Right Whale Habitat</b>								
3.1.1	Compile or collect data to characterize important habitat features and potential sources of human-caused destruction and degradation of critical habitats.	2	ongoing	NESDIS, NMFS, NOS	10	15	20	25	20
3.1.2	Monitor human activities to assess potential right whale habitat degradation.	2	ongoing	ACOE, MMS, NEIT, NMFS, SEIT, States	10	20	15	10	10
3.1.3	Monitor essential habitat features to assess potentially detrimental shifts in these features.	2	ongoing	NMFS, States	15	20	15	15	15
3.1.4	Develop, implement, and monitor habitat protection strategies.	1	ongoing	ACOE, EPA, MMS, NMFS, States	15	25	30	30	20
3.1.5	Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.	2	ongoing	NMFS, NOS, States	25	25	25	25	25
3.1.6	Conduct comparative studies to more accurately characterize critical habitats.	2	5	NMFS	15	15	15	15	15
3.1.7	Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.	2	ongoing	DFO, DOS, NMFS	*	*	*	*	*

### North Atlantic Right Whale Population Implementation Schedule

3.1.8	Support Canadian efforts to protect known right whale habitat in Canada.	2	ongoing	DFO, NMFS	20	20	25	25	30
3.1.9	Support efforts to collect and compile data on habitat use patterns for the eastern North Atlantic right whale population.	3	ongoing	NMFS	10	10	10	10	10
3.1.10	Collaborate with international authorities to protect habitat (when and if identified) for the eastern North Atlantic right whale population	3	ongoing	NMFS	*	*	*	*	*
<b>3.2</b>	<b>Assess modifying critical habitat boundaries.</b>								
3.2.1	Analyze available data and collect additional whale sighting data to assess the modification of critical habitat boundaries.	2	2	NEIT, NMFS, SEIT, States	70/#	50	*	*	*
3.2.2	Revise critical habitat boundaries, if warranted.	2	3	NMFS, States	*	*	*	*	*
	<i>Coastal Development</i>								
3.3.1	Conduct studies to determine the effects of coastal development activities on the distribution, behavior, and productivity of right whales.	2	5	ACOE, NEIT, NMFS, SEIT, States	140	140	140	100	100
3.3.2	Minimize identified adverse effects from coastal development, as feasible.	2	5	ACOE, NMFS	*	*	*	*	*
	<i>Anthropogenic Noise</i>								

### North Atlantic Right Whale Population Implementation Schedule

3.3.3	Conduct studies to assess the effects of anthropogenic noise on the distribution, behavior, and productivity of right whales.	3	5	NMFS, USN	80	120	120	100	60
3.3.4	Take steps to minimize identified adverse effects to right whales from anthropogenic noise.	2	5	ACOE, MMS, NMFS, USN, USCG	*	*	*	*	*
	<i>Pollutants</i>								
3.3.5	Conduct studies to assess possible adverse effects of anthropogenic pollutants on right whales and their habitats.	2	5	EPA, NEIT, NIST, NMFS	35	50	80	80	80
3.3.6	Take steps to minimize identified adverse effects from anthropogenic pollutants.	2	ongoing	EPA, NMFS	30	20	20	15	10
3.3.7	Conduct studies of individual health and body condition.	2	ongoing	NMFS	120	200	200	180	150
	<i>Oil and Gas Exploration and other Industrial Activities</i>								
3.3.8	Conduct studies to assess possible adverse effects of oil, gas, hard mineral exploration, and other industrial activities.	3	4	EPA, MMS, NMFS	*	*	60	80	-
3.3.9	Minimize identified adverse effects from oil, gas, and hard mineral exploration and development.	3	5	MMS, NMFS	*	*	*	*	*
3.3.10	Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.	3	5	MMS, NMFS	*	5	15	15	15



### North Atlantic Right Whale Population Implementation Schedule

3.3.11	Assess and update existing contingency plans for oil and chemical spills in waters in which right whales occur.	3	5	MMS, NMFS, NOS, States, USCG	80	60	30	20	15
	<i>Whale Watching</i>								
3.3.12	Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels	3	4	NMFS, States	15	25	25	5	-
3.3.13	Assess the effectiveness of existing restrictions on whale watching activities.	3	5	NMFS, States	*	*	*	*	*
3.3.14	Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.	1	ongoing	NEIT, NMFS, SEIT, States, USCG	10/#	5	5	5	5
<b>3.4</b>	<b>Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales.</b>	2	5	NMFS	25	20	20	15	15
3.4.1	Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.	2	3	NMFS	5	10	5	-	-
3.4.2	Review and refine energetic models to better understand right whale food requirements and feeding strategies.	2	3	NMFS	5	5	5	-	-
<b>Objective 4</b>	<b><i>Monitor the status and trends of abundance and distribution of the North Atlantic right whale stock</i></b>								

### North Atlantic Right Whale Population Implementation Schedule

	<i>Status</i>								
4.1	<b>Develop quantitative recovery criteria population models to determine extinction risk.</b>	1	2	NMFS	-	10	10	-	-
4.2	<b>Conduct a study or a workshop to determine the best methods for assessing right whale status and trends.</b>	2	1	NMFS	-	15	-	-	-
4.3	<b>Assess population size, survival rate and trends on a regular basis.</b>	2	ongoing	NEIT, NMFS, SEIT	10	10	10	10	10
4.3.1	Review and evaluate the status of the North Atlantic right whale at least once every three years. Continue to review stock assessment at least annually in accordance with the MMPA. If needed, improve data collection and analysis methods.	2	ongoing	NMFS	10	-	-	20	-
4.3.2	Develop and implement other population monitoring programs, as necessary.	2	ongoing	NMFS	10	10	10	10	10
	<i>Distribution</i>								
4.4	<b>Monitor right whale occurrence and habitat use patterns in known high-use areas.</b>								
4.4.1	Continue to conduct annual winter surveys for right whales off the southeast U.S. coast.	1	ongoing	ACOE, NMFS, States, USCG, USN	350	350	370	400	400
4.4.2	Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.	1	ongoing	DFO, NMFS	80/#	100	100	120	150

### North Atlantic Right Whale Population Implementation Schedule

4.4.3	Continue annual spring surveys for right whales in the Great South Channel.	1	ongoing	NMFS, USCG, States	180/#	180	180	200	200
4.4.4	Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.	1	ongoing	NMFS, USCG, States	180/#	180	180	200	200
4.4.5	Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.	1	ongoing	NMFS	50/#	70	70	90	100
4.4.6	As often as possible and where feasible, photo-identification photographs should be obtained at each sighting.	2	ongoing	NMFS, States, Contractors	*	*	*	*	*
4.4.7	Conduct studies to locate heretofore unknown high-use areas for this population.	1	3	NMFS	80	170	170		
4.4.8	Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, historical data, and predictive models.	2	4	NMFS	30	50	50	20	
4.4.9	Conduct surveys and/or support efforts to determine eastern North Atlantic right whale occurrence in European and North African waters	3	3	NMFS	15	15	15		
4.4.10	Continue to maintain a database of right whale sightings.	2	ongoing	NMFS	100/#	100	100	110	110
<b>4.5</b>	<b>Maintain a Photo-Identification Database</b>								

### North Atlantic Right Whale Population Implementation Schedule

4.5.1	Maintain and routinely update the right whale photo-identification catalog.	2	ongoing	NMFS	80	80	80	80	80
4.5.2	Require that right whale researchers provide photographs obtained from their studies to the curators of the photo-identification catalog.	2	ongoing	NMFS	*	*	*	*	*
4.5.3	Regularly review, evaluate, and update analyses of data in the right whale photo-identification catalog.	2	ongoing every 2 yrs	NMFS	20	20	20	25	20
4.5.4	Conduct studies to determine population structure using photo-identification data.	2	3	NMFS	20	50	60		
<b>4.6</b>	<b>Respond to Strandings</b>								
4.6.1	Continue and improve program for necropsy of right whale carcasses	1	ongoing	NEIT, NMFS, NOS, SEIT, States	100	80	80	60	50
4.6.2	Review and improve procedures for responding to reports of dead right whales and conducting necropsies.	1	5	NEIT, NMFS, NOS, SEIT, States	50	40	*	*	*
4.6.3	Improve, develop and implement protocols for securing and retrieving stranded or floating right whale carcasses.	2	5	NEIT, NMFS, NOS, SEIT, States	40	30	20	*	*
4.6.4	Use necropsies to determine the cause of death, and use such data to reduce mortalities.	2	ongoing	NEIT, NMFS, NOS, SEIT, States	5	5	10	10	10
4.6.5	Analyze tissue collected from stranded right whales to determine and monitor contaminant levels.	2	ongoing	EPA, NIST, NMFS	10	20	15	10	10

### North Atlantic Right Whale Population Implementation Schedule

4.6.6	Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales.	2	ongoing	NMFS	10	10	10	10	10
4.6.7	Review, analyze, and summarize data on stranded right whales on a regular basis.	2	ongoing	NMFS	5	5	10	10	15
4.6.8	Develop and implement a program for handling live-stranded right whales.	1	ongoing	NMFS	50	50	50	50	50
4.6.9	Develop protocols for handling live-stranded right whales, including identification of appropriate rehabilitation sites.	2	5	NMFS	25	10	*	*	*
4.6.10	Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.	2	5	NMFS	*	*	*	*	*
<b>4.7</b>	<b>Conduct Habitat Use Studies (using telemetry)</b>								
4.7.1	Conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and habits.	1	5	NMFS	100	100	100	120	140
4.7.2	Conduct studies to assess the most effective and least intrusive means of tagging right whales.	1	5	NMFS, USN	100	80	70	20	*
4.7.3	Conduct studies by veterinary experts to assess short- and long-term physiological impacts of tagging.	2	3	NMFS	20	15	15		

### North Atlantic Right Whale Population Implementation Schedule

4.7.4	Continue and expand satellite-linked radio-tagging and tracking to better identify right whale movements and habitat use patterns	2	5	NMFS, USN	150	150	150	80	45
4.7.5	Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats	2	5	NMFS, USN	90	80	80	80	70
4.7.6	Conduct monitoring surveys to check for other right whales in the area of the tagged whale.	2	5	NMFS, Contractors	50	50	50	50	50
4.7.7	Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas	2	5	NMFS, USN	25	35	50	30	30
<b>4.8</b>	<b>Assess Demography and Stock Structure</b>								
4.8.1	Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success.	3	3	NMFS			15	20	15
4.8.2	Conduct genetics workshop.	3	1	NMFS			5		
4.8.3	Conduct studies of population demographics.	2	3	NMFS		15	15	15	
<b>4.9</b>	<b>Reproduction and Health Assessment</b>								

### North Atlantic Right Whale Population Implementation Schedule

4.9.1	Conduct studies to determine the causes(s) of anomalous or fluctuating reproductive rates.	2	5	EPA, NMFS, States, USDA	100	120	120	150	100
4.9.2	If cause(s) of reproductive anomalies are linked to human activities, establish programs to mitigate or eliminate the sources of the impact.	1	5	EPA, MMS, NMFS, NOS, States, USCG, USDA	50	80	80	80	80
4.9.3	Conduct studies to assess health at the individual and population level.	2	5	EPA, NMFS, States, USDA	120	180	180	200	200
4.9.4 4.9.4	Establish programs to mitigate or eliminate sources of the impact if studies indicate that poor individual or population health is linked to human activities.	1	5	EPA, MMS, NMFS, NOS, States, USCG, USDA	50	80	80	80	80
<b>Objective 5</b>	<b><i>Coordinate Federal, State, international, and private efforts to implement the Recovery Plan</i></b>								
<b>5.1</b>	<b>Continue international ban on hunting and other directed takes of right whales.</b>	1	ongoing	IWC, NMFS, DOS	*/#	*	*	*	*
<b>5.2</b>	<b>Enforce right whale protection laws.</b>	1	ongoing	NMFS, USCG	180/#	200	250	250	300
<b>5.3</b>	<b>Evaluate the effectiveness of the Northeast and Southeast Implementation Teams.</b>	3	1	NEIT, NMFS, SEIT	*	-	-	-	-
<b>5.4</b>	<b>Coordinate with States involved in right whale activities to maximize protection measures</b>	1	ongoing	NEIT, NMFS, SEIT, States	*	*	*	*	*

<b>5.5</b>	<b>Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales.</b>	1	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
5.5.1	Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures.	2	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
5.5.2	Promote actions to enhance protection for areas of importance, especially vessel and fishery interaction issues in Canadian waters.	1	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
<b>5.6</b>	<b>Periodically review and update the North Atlantic Right Whale Recovery Plan</b>	1	ongoing	NMFS, NEIT, SEIT	*	*	*	*	*
<b>5.7</b>	<b>Prepare delisting monitoring plan for species before delisting occurs.</b>	3	ongoing	NMFS	*	*	*	*	*

\* No direct cost associated with this task (NMFS staff time)

+ Task already completed

# Task already underway



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## **VII. APPENDICES**

### **A. CONSULTATION HISTORY**

Under section 7 of the ESA and implementing regulations at 50 CFR 402.14, Federal agencies are required to review their actions and consult with NMFS on any action that may affect listed species or critical habitat for species under NMFS' jurisdiction (including right whales). Many of the recovery activities for all endangered and threatened species are implemented through consultations between NMFS and other Federal agencies. As a result of these consultations, NMFS issues either a letter of concurrence that any activity is not likely to adversely affect a species or critical habitat, or a Biological Opinion for activities likely to adversely affect a species or critical habitat. A Biological Opinion indicates if the activity is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat and, if so, provides reasonable and prudent alternatives to the activity. In those cases where NMFS concludes that an action (or implementation of any reasonable and prudent alternatives) and the resultant incidental take of listed species is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat, NMFS specifies reasonable and prudent measures necessary and appropriate to minimize effects of the action on the species of concern.

Consultations between NMFS and the USCG and the U.S. Navy follow. Additional consultations between NMFS's Office of Protected Resources and NMFS's Office of Sustainable Fisheries (on the issuance of fishery management plans) are also discussed in the following section.

#### Consultation with the U.S. Coast Guard:

The USCG and NMFS have cooperated informally for many years. For example, since 1993, USCG ship and aircraft operators have provided reports of numerous "floaters", carcasses adrift at sea. Also, USCG vessels have been available to transport researchers and disentanglement teams to stranded and entangled whales, and vessels and aircraft have been deployed to photo-document or when possible, recover floaters. As noted elsewhere in this document, the USCG has been an active participant in regional recovery plan implementation teams and has contributed to aircraft surveillance and sighting location communication systems. This effort also involves NMFS staff providing training and materials to USCG vessel and aircraft personnel. In addition, as noted above, the USCG is working jointly with NMFS to administer the Mandatory Ship Reporting system.

In 1991 and in 1993, USCG vessels collided with and killed right whales. In addition, a USCG vessel struck a humpback whale in 1995 and another potentially had an interaction with a humpback whale in 1997. These events triggered ESA Section 7 consultations with NMFS.

On 15 September 1995, NMFS issued a Biological Opinion on USCG vessel activities which concluded that the programs implemented since the 1993 incident were adequate to reduce the probability of another ship strike. That factor, combined with available information indicating a small but steady 2.5 percent population growth rate, resulted in a determination that continued vessel activities may adversely affect, but would not jeopardize the continued existence of the right whale population. However, on 7 November 1995, the USCG reinitiated consultation. The new Biological Opinion, issued in June 1996, rendered a different (jeopardy) conclusion. This conclusion was based on the increased level of known mortality and the potential magnitude of those impacts to the population, including the possibility that the northern right whale might have been experiencing a population decline; the potential biological removal figure for the northern

right whale and its small population size; the lack of any measurable recovery progress for the northern right whale; and the cumulative sources of human-induced mortality.

The June 1996 Biological Opinion provided the USCG with reasonable and prudent alternatives, stating that the USCG must significantly reduce the possibility of vessel collisions with right whales, including those by non-USCG vessels where the agency has the authority to act. If implemented fully and in a timely manner, the alternatives would significantly reduce the USCG's potential to cause injury or mortality to a right whale and, therefore, would avoid the likelihood of jeopardizing the continued existence of right whales. The following are significant measures put forth by both the 1995 and 1996 opinions, considered necessary to ensure that USCG vessel operations were not likely to jeopardize the north Atlantic right whale:

*When and where possible, routine transits should avoid right whale habitats when whales are aggregated there. During standard operations, USCG vessels should maintain minimum distances of 500 yards from right whales and 100 yards from other large whale species.*

*All USCG vessels must post dedicated lookouts during all transits, both emergency and non-emergency, that occur within 20nm of shore in addition to posting lookouts during transits in all right whale high-use areas. Vessel operators should also take necessary precautions to avoid whales.*

*All dedicated lookouts must have completed a marine mammal training program. This requirement should be standardized and made part of USCG qualification criteria for bridge watch standers. The training should also increase the effectiveness of the agency in whale watch enforcement actions and in providing disentanglement assistance.*

*From mid-December through March in the SEUS, broadcasts reporting right whale sightings should be transmitted as quickly as possible over all practicable means to as wide a distribution of vessels possible. The message should advise mariners within 15 nautical miles (nm) of the sighting to operate at the slowest safe speed, exercise caution, and keep a watch for right whales.*

*The USCG should continue its active participation in regional recovery plan implementation teams, and provide support for aerial surveys during periods of high use in the different regions.*

*The USCG must provide information to commercial and recreational vessel operators that is geared to avoiding collisions with endangered whales. It should include information to identify whales, what the operator can do to avoid causing them harm, critical habitat and high-use areas, and regulations applicable to the protection of right whales. Operators must be instructed to report all collisions or sightings of dead right whales immediately. Also, the USCG will work with appropriate agencies to ensure that publications commonly used by U.S. mariners for voyage planning purposes (i.e., the Coast Pilot and Sailing Directions) include information useful to avoiding vessel collisions with endangered whales. In addition, the USCG must continue to provide timely information on endangered whale sighting locations to commercial vessels coming into major ports in both the New England and Georgia/Florida critical habitats. The USCG must develop, in cooperation with NMFS, a plan to alert commercial traffic through port pilots, Captain's of the Port, Vessel Traffic Service, and others who are aware of the expected arrival time of ships in the various ports, and request them to relay this information to shippers.*

The USCG once again entered into consultation following the July 1997 interaction with a humpback whale. NMFS issued a Biological Opinion on 18 May 1998, which provided a non-jeopardy decision (contingent upon implementation of all previous requirements of the 1995 and 1996 Biological Opinions) and provided a number of conservation recommendations. Among other things, NMFS recommended that the USCG:

- *evaluate all its authorities to identify opportunities to take affirmative actions to conserve threatened and endangered species in fulfillment of section 7(a)(1) of the Endangered Species Act;*
- *assess mission requirements such as full power trials so that they can be scheduled during times of year and in areas where/when they present the least hazard to endangered and threatened species;*
- *periodically review compliance with the speed guidance it has issued, including interviews and surveys of Commanding Officers as part of a monitoring program to evaluate their knowledge or understanding of the speed guidance;*
- *provide assistance in identifying, reporting, marking and towing right whale carcasses to a location for necropsy;*
- *initiate the Gulf of Mexico operations and “marine event” consultations within 6 months of issuance of the Biological Opinion;*
- *continue training courses for USCG lookouts; develop information on critical habitats, marine sanctuaries, and endangered species migration routes, feeding areas, and breeding areas for use by mariners and boaters; distribute information geared toward cautioning commercial and recreational vessel traffic about collisions with right whales as part of the USCG Vessel Documentation and Inspection Program; educate mariners about right whales and other protected marine species through International Safety Management code policy documents; modify training courses for safety auditors and inspectors and USCG personnel responsible for safety inspections and ensure that these courses are being modified to include information on right whales and other protected marine species; and*
- *assist in development and implementation of the mandatory ship reporting system.*

In general, the USCG has made a strong and active effort to implement the reasonable and prudent alternatives and conservation recommendations identified in the Biological Opinions.

#### Consultation with the U.S. Navy:

In the first three months of 1996, six right whale deaths were documented. Five of these occurred in waters adjacent to SEUS critical habitat. Navy facilities are adjacent to the critical habitat and use offshore areas for gunnery exercises. Because several of the carcasses were found near a Navy gunnery range, it is possible that some deaths may have been related to underwater explosions and there was concern that Navy activities may have been involved in some deaths. Given the serious concern over the status of right whales, the Navy and NMFS began convening meetings in mid-February 1996. Although there was no clear evidence linking the right whale deaths to the Navy's

activities, the Navy formally initiated consultation with NMFS in March 1996 on the potential impacts of their gunnery and air-dropped ordnance operations in waters off the SEUS. The purpose of this consultation was to ensure that the Navy was taking all appropriate measures to protect right whales and to determine, if possible, the cause(s) of death of the whales. The scope of the consultation was expanded to include all Navy vessel and aircraft activities related to training in the consultation area. NMFS issued a (non-jeopardy) Biological Opinion on these specific Navy activities in May 1997.

Among the protective or mitigative measures considered prior to issuance of the Biological Opinion were: moving gunnery and ordnance activities well outside critical habitat and contiguous high-density areas; limiting the scope of naval activities in critical habitat and adjoining areas to those that occur at a slow, safe speed; moving other activities that require higher vessel speeds away from the critical habitat and adjoining areas; limiting vessel traffic in these areas to the extent possible; and providing dedicated lookouts for surface ships while operating in critical habitat.

By early-1996 (prior to issuance of the Biological Opinion) the Navy had already taken steps to alter its operations to minimize potential impact to right whales. These measures included (a) instructing all Navy ships entering or leaving port to follow an east-west course (*i.e.*, the shortest route) through critical habitat; (b) altering most Navy ship operations to use moderate speed (10-15 knots) in the critical habitat when no right whales were present and slower speeds when whales were near the ship; (c) providing special training in whale identification for lookout and bridge watch personnel and directing ship officers to stay well clear of whales; (d) committing to continued participation in regional sighting advisory systems; and (e) moving gunnery and aircraft bombing training sessions at least 50nm from shore. These and other protective measures remain in effect.

#### Consultations on Various Fisheries:

American Lobster Fishery: In December 1996 a Biological Opinion was issued following a consultation on fishing conducted under the American Lobster Fishery Management Plan. The opinion concluded that operations under the current Fishery Management Plan (FMP), including anticipated management actions over the next six months, were likely to jeopardize the continued existence of the northern right whale, but were not likely to jeopardize any other endangered or threatened species under NMFS jurisdiction. The reasonable and prudent alternatives identified in the opinion led to the publication of an emergency interim regulation under the authority of the MMPA (62 FR 16108, 4 April 1997) that restricted the use of lobster pot gear in CCB critical habitat from 1 April to 15 May, and in the GSC critical habitat from 1 April to 30 June. The State of Massachusetts implemented a similar closure in CCB critical habitat in state waters. These closures remain in effect until gear modifications or alternative fishing practices are approved that minimize the risk of entanglement or reduce the likelihood that an entanglement will result in serious injury or mortality.

The opinion also tasked NMFS with analyzing fishing effort in relation to whale distribution. NMFS analysis, in coordination with the states, has begun to assess fishing effort, but models to predict shifts in effort have not yet been developed. This alternative is a long-term measure, which, in combination with the closures as short-term measures, and in combination with an expanded disentanglement response network capability, brought the impact of the fishery to below the jeopardy threshold for right whales.

Under the Atlantic Coastal Cooperative Fishery Conservation and Management Act, NMFS worked with the Atlantic States Marine Fisheries Commission to develop a new management strategy for the lobster fishery. A multi-state plan was developed and is being implemented. Northeast Multispecies Groundfish Fishery: Consultation was undertaken on fishing conducted under the Multispecies FMP. A Biological Opinion, issued in December 1996, concluded that actions under this FMP were likely to jeopardize the continued existence of the northern right whale, but were not likely to jeopardize any other endangered species under NMFS jurisdiction. The alternatives included short-term measures to prevent jeopardizing right whales, with longer term solutions expected later. As a result of the alternatives identified in the opinion, NMFS worked with the New England Fishery Management Council to develop regulations under the authority of the Magnuson-Stevens Fishery Management and Conservation Act (62 FR 15425, 1 April 1997). The regulations closed Federal waters to multispecies gillnet gear in parts of the following right whale critical habitat areas: CCB from 27 March 1997 to 15 May 1997, and from 1 January to 15 May in subsequent years; and the GSC from 1 April to 30 June, annually. Concurrently, the State of Massachusetts prohibited gillnets from critical habitat in CCB within state waters from 1 January to 15 May. In addition, other closures are in effect under the multispecies plan for purely fishery management reasons and for protection of harbor porpoises (*Phocoena phocoena*).

Atlantic Fisheries for Highly Migratory Species: The Atlantic Pelagic Fishery for swordfish, tuna and shark was reviewed under an intra-agency consultation to address the potential for right whale entanglement in gear used in these fisheries. The resulting Biological Opinion concluded that continued operation of the southeastern Atlantic gillnet fishery for shark which occurs when right whales are present in SEUS critical habitat was likely to jeopardize the continued existence of the right whale. One report potentially linking a right whale mortality to the shark driftnet fishery occurred off Florida. The marks on a freshly wounded right whale calf were consistent with gillnet gear; and the shark fishery was the only gillnet fishery operating in the area at the time. Therefore, one of the primary alternatives was closure of shark driftnet operations in SEUS critical habitat and adjacent waters from 15 November – 31 March, consistent with the Atlantic Large Whale Take Reduction Plan. In another incident, a right whale was observed entangled in a swordfish driftnet in the northeast. However, the Biological Opinion concluded that the probability of an interaction with this fishery in the offshore area, where the northeast segment of this fishery generally operates, is remote since right whale occurrence in these areas is infrequent. Also, the whale involved in the incident had already been compromised by a previous entanglement in lobster gear. However, it was noted that the winter/spring, mid-Atlantic component of this fishery had the greatest potential of the northern components to entangle right whales because the fishery was operating on the shelf edge which is much closer to shore in the mid-Atlantic. Therefore, the opinion also recommended closure of the winter pelagic driftnet fishery for swordfish, tuna, and sharks to protect right whales. Other recommendations included educational workshops for fishermen, implementation of a limited access system, and 100 percent observer coverage (an observed take would close the fishery). The conclusions of this opinion led to an emergency closure of the fishery from December 1996 to June 1997; the closure was subsequently extended for six months. NMFS issued an amended opinion in August 1997 to evaluate the impacts of this fishery on endangered and threatened species. This amended opinion again recommended closure of the mid-Atlantic (winter) pelagic driftnet fishery for swordfish, tuna, and shark. NMFS issued a rule extending the closure, under authority of the ESA, to August 1998.

In January 1999, NMFS published a final rule to prohibit the use of driftnets in the pelagic swordfish and tuna fishery. NMFS expressed concern about the high marine mammal bycatch level in this fishery and the difficulty in managing such a limited fishery under bycatch reduction

constraints. In October 1998, NMFS issued a proposed rule to prohibit pelagic driftnets in the Atlantic tuna fishery and the final rule was published in 1999.

American Lobster Fishery, Multi-species Groundfish Fishery, Monkfish Fishery, and Spiny Dogfish Fishery: In May 2000, NMFS requested consultation on Fisheries Management Plans for the (a) American Lobster Fishery, (b) Multi-species Groundfish Fishery, (c) Monkfish Fishery, and (d) Spiny Dogfish Fishery. The requests for consultation were made because of several right whale entanglements in 1999, one resulting in the death of a right whale; two additional right whale deaths in the recent years, one in which fishing gear was implicated as a contributing factor; and new information provided by the International Whaling Commission regarding modeling results indicating that the North Atlantic right whale population may be declining. In the Biological Opinions resulting from the consultations, NMFS concluded that the prosecution of the fisheries under the management plans was likely to jeopardize the continued existence of the North Atlantic right whale, but not likely to jeopardize the continued existence of humpback, fin, sei, blue, and sperm whales. The Opinions, issued on 14 June 2001, identified reasonable and prudent alternatives for execution by NMFS, which included:

- developing and implementing annual restrictions to fishing operations aimed at minimizing interactions between fisheries and right whales, with a management strategy to be implemented by a final rule no later than December 31, 2001;
- implementing a “dynamic area management” program to supplement annual restrictions with temporary closures at times and in places where right whales aggregate, with the final strategy to be implemented with a rule no later than 31 December 2001;
- expanding gillnet gear modification research program and extension of gear modification requirements to include waters off mid-Atlantic and southeast states; and
- monitoring and evaluating the effectiveness of the measures identified in the reasonable and prudent alternatives.

NMFS implemented the fishery restrictions provided under the reasonable and prudent alternatives through three rules that (1) make further modifications to commercial fishing gear (67 FR 1300, January 10, 2002; see also 67 FR 15493, April 2, 2002; 67 FR 59471, September 23, 2002), (2) establish restricted areas based on annual, predictable aggregations of right whales (67 FR 1142, January 9, 2002), and (3) establish a system for restricting fishing in areas where unexpected aggregations of right whales are observed (67 FR 1133, January 9, 2002; see also 68 FR 51195, August 26, 2003).

## **B. GLOSSARY AND LIST OF ABBREVIATIONS**

ACOE – Army Corps of Engineers  
ALWTRT – Atlantic Large Whale Take Reduction Team  
CCB – Cape Cod Bay  
CCS – Center for Coastal Studies  
DFO – Department of Fisheries and Oceans (Canada)  
DPS – Distinct Population Segment  
DOS – Department of State  
EEZ – Exclusive Economic Zone  
EPA – Environmental Protection Agency  
ESA – Endangered Species Act  
EWS – Early Warning System  
FMP – Fishery Management Plan  
GIS – Geographic Information Systems  
GSC – Great South Channel  
IFAW – International Fund for Animal Welfare  
IMO – International Maritime Organization  
IWC – International Whaling Commission  
MA – Massachusetts  
MET – Massachusetts Environmental Trust  
MMC – Marine Mammal Commission  
MMPA – Marine Mammal Protection Act  
MMS – Minerals Management Service  
MSR – Mandatory Ship Reporting  
NEA – New England Aquarium  
NEC – Northeast Fisheries Science Center  
NEIT – Northeastern Implementation Team  
NER – Northeast Region Office  
NESDIS – National Environmental Satellite Data and Information Service  
NIMA – National Imagery and Mapping Agency  
NIST – National Institute of Standards and Technology  
NMFS – National Marine and Fisheries Service  
NOAA – National Oceanic and Atmospheric Administration

NOS – National Ocean Service  
PAH – Polynuclear Aromatic Hydrocarbons  
PCB – Polychlorinated Biphenyls  
SBNMS – Stellwagen Bank National Marine Sanctuary  
SEIT – Southeastern Implementation Team  
SEUS – Southeast United States  
SOSUS – Sound Surveillance System  
USDA – U.S. Department of Agriculture  
USCG – U.S. Coast Guard  
USN – U.S. Navy



## C. THREATS ANALYSIS (THE FIVE LISTING FACTORS)

Section 4(a)(1) of the ESA requires that any determination of the status of a species consider possible threats (or reduction of threats) to a species in five areas (i.e., the five factors for listing). That is, threats to a species resulting from activities in one or more of the five areas is sufficient justification to add a species to the List. 50 CFR 424.11(d) provides that the same five factors must be considered in any de- or down-listing action. Thus, reasonable justification and data need to be provided indicating that significant threats, or inadequate protection, are not still posed in any one these areas. In this regard, *addressing the five factors is a necessary component of the criteria* identified here when considering reclassification of North Atlantic right whales.

### *(A) The present or threatened destruction, modification, or curtailment of its habitat or range*

In any reclassification action, reasonable justification and data need to be provided that habitat destruction or degradation is not a factor in continued recovery of the population.

Unlike many terrestrial species, right whales and other cetaceans do not directly compete with a burgeoning human population for space (Clapham *et al.* 1999). Since humans do not permanently colonize marine environments, habitat loss (in the strict sense of the term) is not, at this time, believed to be a serious issue for most large whales. However, since right whales are often dependent on restricted waters adjacent to highly developed coastline, habitat degradation may not be a trivial matter for this species, and in fact threats can certainly arise from onshore and near shore activities.

Probably the most tangible source of habitat degradation for baleen whales is spilled oil. Data on the effects of oil pollution on cetaceans are inconclusive, and the large baleen whales appear to be generally unaffected by oil *per se* (Geraci 1990, Loughlin 1994b). General concerns with regard to oil pollution are ingestion of contaminated prey, potential irritation of skin and eyes, inhalation of toxic fumes, and abandonment of polluted feeding habitat (Geraci and St. Aubin 1980, Geraci 1990). Currently, there are no known plans for oil exploration in the major habitats of the North Atlantic right whale, but the possibility remains for the future.

The potential for additional habitat degradation comes from a variety of sources. The effect on critical behavior (foraging, mating, nursing etc.) of noise pollution from shipping or oil and gas development is unclear, although various observations suggest that marine mammals can habituate well to even quite high levels of sound (Geraci and St. Aubin, 1980, Richardson *et al.* 1995). Playback experiments on gray and bowhead whales indicate that whales will actively avoid a very loud sound source (Malme *et al.* 1983), but whether real-life sources (such as drilling platforms) negatively impact behavior to the point that it diminishes reproductive success and population productivity is unclear.

There are some suggestions that increased pleasure boat traffic disrupts behavior (e.g., in humpback whales, (Glockner-Ferrari and Ferrari 1990)). Such craft as parasails, jet skis and fast power boats can pose a threat to whales even if their operators are not intentionally focusing their attention on the animal itself. Pleasure boat traffic exists in various coastal areas, with little regulation or enforcement; however, its impact on right whales is unknown.

Dredging of harbors and port channels occurs in a number of locations in or near areas where right whales aggregate. Noise, ship traffic, disposal of dredge material and related activities may all

serve to degrade right whale habitat. The overall effect is unknown. At present, efforts are made to reduce adverse effect on right whales, primarily by posting observers on ships transporting dredge spoils to reduce the risk of ship strikes. More information is needed to determine specific impacts, if any, from these activities.

A final source of possible habitat degradation for right whales is contaminants. The impact of pollutants on right whales is debatable. The subject is reviewed by O'Shea and Brownell (1994), who conclude that there is currently no evidence for significant contaminant-related problems in baleen whales. Although much more research needs to be conducted, existing data on mysticetes support the view that the lower trophic levels at which these animals feed should result in smaller contaminant burdens than would be expected in many odontocetes, which typically show burdens that differ from those of baleen whales by an order of magnitude (O'Shea and Brownell, 1994). There is currently no persuasive evidence for any of the problems that have been linked to excessive contaminant burdens in some terrestrial mammals, such as reproductive failure or immune system suppression (e.g., mink, *Mustela vison*; Kihlström *et al.*, 1992). However, the manner in which pollutants negatively impact animals is complex and difficult to study, particularly in taxa (such as large whales) for which many of the key variables and pathways are unknown (Aguilar, 1987; O'Shea and Brownell, 1994). A more plausible potential problem is that of transgenerational accumulation (Colborn and Smolen 1996), but this remains unstudied in right whales or any other cetacean.

As noted above, if a change in North Atlantic right whale listing status is proposed, these issues need to be carefully assessed and determinations made that they no longer adversely affect right whales and are not likely to do so in the foreseeable future.

*(B) Overutilization for commercial, recreational, scientific, or educational purposes*

Right whales have not been the target of commercial hunting in the North Atlantic since 1935, and relatively few catches were made in the 20<sup>th</sup> century prior to that date. As noted elsewhere in this plan, there is no evidence that the illegal harvest of whales by the USSR included any North Atlantic right whales.

With regard to recreational and educational use, problems may arise from boats whose operations are directed at the whales themselves, i.e., whalewatching from either commercial or private vessels. It is likely that large-scale, unregulated whalewatching, involving numerous boats circling and pursuing a whale, will temporarily disrupt vital behavior such as feeding, courtship, and nursing. The impact of such harassment on the reproductive success of individuals has not been studied and is unknown, but continued exposure of any individual whale to such activity is probably relatively low. Currently, close approach by vessels within 500 yards of North Atlantic right whales (if in U.S. waters) is not permitted, although this activity is allowed in Canada.

Scientific activities on right whales frequently involve close approaches to the animals for the purpose of photographic, genetic, or behavioral sampling. These activities are controlled by permits in both U.S. and Canadian waters, and potential negative impact on the animals is considered in the permitting process. At present, there is little restriction to the number of scientific permits or the types of scientific activities undertaken, and efforts are needed to ensure coordination of research activities between U.S. and Canada and among researchers.

If reclassification is considered for the north Atlantic right whale, absolute assurances are needed that right whales are not being taken for commercial purposes. In addition, assurances are needed that whalewatching and scientific research activities are not affecting population ecology of right whales and are not likely to do so in the foreseeable future.

*(C) Disease or predation*

Unlike in some dolphin and pinniped (i.e., seals and sea lions) species, there have been no recorded epizootics in baleen whales. The only known case of a mass mortality was that of humpback whales in the southern Gulf of Maine in 1987/88. Geraci *et al.* (1989) provide strong evidence that these deaths resulted from consumption of mackerel whose livers contained high levels of saxitoxin, a naturally occurring red-tide toxin, the origin of which remains unknown. It has been suggested that red tide phenomena are somehow related to increased freshwater runoff from coastal development, a link that has led some observers to suggest that such events may become more common among marine mammals. However, there is currently no evidence linking red tide toxins to deaths or chronic health problems in right whales.

The occurrence of skin lesions on North Atlantic right whales has been documented in recent years, with an apparent increase in frequency culminating in a peak in 1995 when they were observed on 24% of photographed individuals (Marx *et al.* 1999). The origins and significance of these lesions are unknown, and further research is required to determine whether they represent a topical or systemic health problem for the affected animals.

Current knowledge of natural predation on right whales is discussed elsewhere in this plan. Predation of right whales likely occurs by killer whales and large shark species, but the level is not documented. Neither assessing the level of predation, nor attempting to alter the level is likely feasible or recommended in any de-listing action. However, evidence of disease in right whales, particularly those that may be directly or indirectly linked to human activities, should be assessed. Any proposal to reclassify right whales needs to provide assurances that disease does not affect the population ecology of the species and is not likely to do so in the foreseeable future.

*(D) The inadequacy of existing regulatory mechanisms*

Right whales are protected under both U.S. and Canadian law, and internationally by the International Whaling Commission, so the overall legal framework and mechanisms appear to be adequate for protecting right whales at this time. However, the rules and regulations put in place under these laws may be insufficient to adequately protect the population. Prior to any proposed change in listing status, such regulations need to be assessed to ensure that they provide adequate protection.

As noted above, death and serious injury resulting from ship strikes and entanglement in fishing gear are significant factors in slowing recovery of this population. A total of 16 known North Atlantic right whale deaths between 1970 and 1999 were attributed to collisions with ships and three to entanglement in fishing gear (Knowlton and Kraus 2001). The actual number of deaths from both sources may be much higher as not all carcasses are detected, reported, and recovered. Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to some other direct cause(s) of mortality. An estimated 60 percent of the North Atlantic right whale population bears scars from fishing gear entanglement. (The level and extent of impact from these human activities are discussed more fully

in the section on Effects of Human Activities, above, and steps needed to reduce or eliminate these threats are discussed in the Recovery Actions and Implementation section, below.) Therefore, it may be necessary to continue or enhance existing regulations, or promulgate new regulations to reduce or eliminate these threats. Prior to any reclassification action, regulations and regulatory mechanisms and the protection they provide need to be assessed, and a determination needs to be made that regulations are adequate to protect North Atlantic right whales from the threats of ship strikes and fishing gear entanglement.

*(E) Other natural or manmade factors affecting its continued existence*

Aside from the factors discussed here and elsewhere in this plan, no other natural factors are *known* to be impairing the recovery of North Atlantic right whales at this time. Among anthropogenic factors, ship collisions and entanglement in fishing gear are clearly inhibiting the recovery of this species. However, other factors may be identified later that directly or indirectly threaten the population, such as reduced productivity from contaminant loads, habitat degradation, including activities that disrupt food webs, or that disrupt vital activities through coastal development, ship traffic, or undersea noise. Although it is unclear if these or any other factors are currently adversely affecting this right whale population, in any contemplated reclassification action, the best available information (data) must be used, and justification provided, to ensure that these or any other factors will not inhibit the population ecology of North Atlantic right whales.

*Conclusion*

If reclassification of North Atlantic right whales is contemplated, threats represented in each of the five listing areas (factors) need to be addressed to ensure such threats are non-existent or insignificant and that existing legal structures are adequate to ensure continued recovery. At the time of this writing, there is currently no evidence that factors (A) through (D) are negatively impacting the reproductive success and productivity (and therefore the recovery potential) of North Atlantic right whales, but further research is clearly warranted in many of the areas identified above to make that assessment with some level of certainty. In contrast, other anthropogenic factors identified under (E), notably ship strike and entanglements, are clearly threatening the recovery of this species.

## D. NORTH ATLANTIC RIGHT WHALE CRITICAL HABITAT

Figure 1: Northeast Critical Habitat

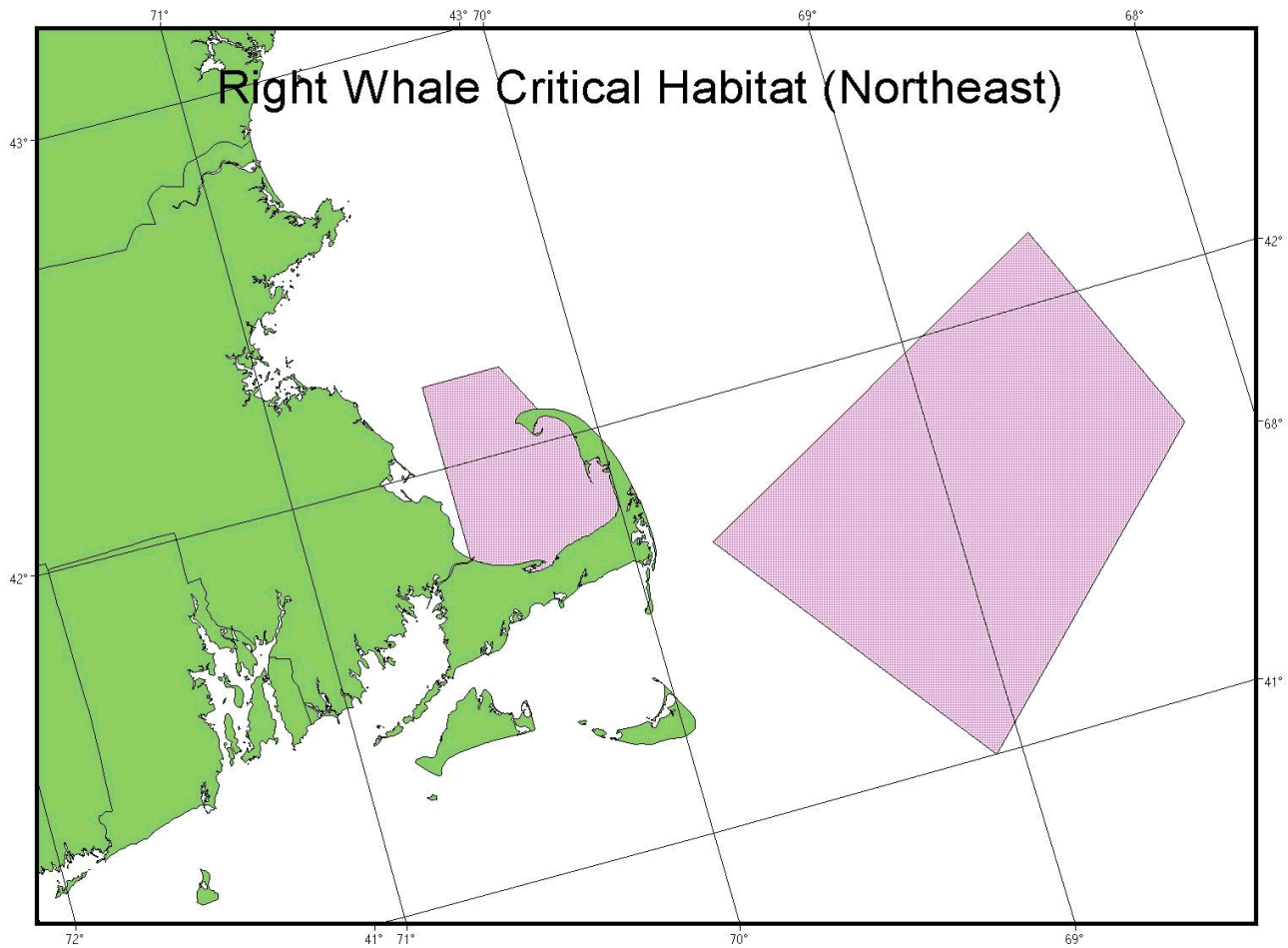


Figure 2: Southeast Critical Habitat

